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# USSR Report

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31 December 1985

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## OIL AND GAS

### USSR GAS SUPPLY SYSTEM: CURRENT STATUS AND DEVELOPMENT PROBLEMS

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 6, Jun 85 pp 3-4

[Article by V.I. Khalatin, Engineer, and M.M. Mayorov, Candidate of Technical Sciences, Central Dispatch Control, USSR Unified Gas Supply System, Soyuzgaz-avtomatika All-Union Scientific Production Association: "USSR Unified Gas Supply System: Current Status and Development Problems." Passages in all caps are underlined in the original for emphasis.]

[Text] The USSR Unified Gas Supply System comprises gas fields, transcontinental gas pipelines and gas refining and storage facilities, organized as a unified technological process.

Dispatcher control of this highly complex gas supply system is provided by extensive automation and modern computer technology.

The pipelines linking producing areas with consuming areas, accounting for over 70 percent of the industry's economic investment, are highly important components of the USSR Unified Gas Supply System. The length of USSR trunk and distribution pipelines considerably exceeds that of the gas pipelines of all the countries of Europe combined. Huge gas deliveries over long distances continue apace due to the construction of 1420-mm gas pipelines at a working pressure of 7.5 MPa and large-capacity units (10, 16 and 25 MW) at compressor stations.

In order to evaluate technical and economic advantages of large-diameter gas pipelines, the following data may be used: the throughput of 1420-mm pipe at 7.5 MPa pressure is up to twice as large as that of 1220-mm pipe at 5.6 MPa, and capital investment and metals requirement percentages are correspondingly lower, 27 percent and 20 percent, respectively.

Over the last few years, due to the increased use of gas in the country's fuel and power mix, operating conditions for the USSR Unified Gas Supply System changed radically. The structure linking gas consumers became more complex, gas production areas became more remote, control processes became more complex, and control and optimization requirements increased. Under these conditions, special attention is being given to the development and implementation of automated control systems, both for the unified gas supply system as a whole and for individual regional and technological facilities within the system.

THE CONTROL SYSTEM OF THE USSR UNIFIED GAS SUPPLY SYSTEM IS BASED ON MODERN ACHIEVEMENTS IN CONTROL-SYSTEM THEORY FOR LARGE ORGANIZATIONAL AND TECHNICAL

SYSTEMS. A SYSTEM IS BEING IMPLEMENTED WHICH IS THE ONLY POSSIBLE HIERARCHICAL APPROACH TO SUCH LARGE-SCALE SYSTEMS THAT SATISFIES TWO MAIN PRINCIPLES: (1) CENTRALIZATION OF DECISION-MAKING, ENSURING A RELIABLE, ECONOMIC SUPPLY OF GAS TO THE NATIONAL ECONOMY AND (2) DECENTRALIZATION OF THE CONTROL OF REGIONS AND INDIVIDUAL INSTALLATIONS COMPRISING THE UNIFIED SYSTEM IN ORDER TO ENSURE THE ECONOMIC PROCESS OF PRODUCING, PIPELINING AND DISTRIBUTING GAS WITHOUT INTERRUPTION.

Automated technological process control systems (ASUTP) for producing and pipelining gas are bilevel systems controlling individual facilities (such as gas treatment installations and compressor stations) and technological systems at the level of production associations.

The upper level of modern ASUTP systems for gas-producing enterprises functions on a data/advisory [informatsionno-sovetuyushchiy] regime. The ASUTP system at a gas-producing enterprise (1) controls the operation of wells, technological installations and gathering facilities, (2) ensures the control and monitoring of productivity and gas treatment quality at treatment facilities and in the field as a whole and (3) processes recommendations for controlling gas treatment facilities. The centralized gathering of technological information is accomplished by TM-120-1 remote control systems while gas storage and processing is handled by control configurations using specialized SM-2M computers.

AUTOMATIC CONTROL SYSTEMS FOR GAS TREATMENT FACILITIES WHICH HAVE BEEN IN OPERATION SINCE 1985 OPERATE IN THE INFORMATION/CONTROL MODE. A remote system (TM-gaz) gathers gas well operations data and transmits commands to automatic production regulators. Microcomputers automatically monitor and control basic technological parameters and set automatic regulators to maintain a given productivity rate at a gas treatment facility.

MODERN GAS TRANSMISSION ASUTP SYSTEMS OPERATE IN THE DATA/ADVISORY MODE. These systems perform basic dispatching control functions and formulate recommendations for controlling technological processes. Gas transmission ASUTP systems (1) automatically gather technological process information using remote devices; (2) control production operations; (3) indicate technical parameters of pipelines and pump station equipment and (4) perform technological calculations for gas transmission operations and scheduling.

TM-120-1 remote systems, MMG [not further identified] systems and computer configurations using SM-2, SM-2M and SM-4 computers, SM-1800-3 and SM-50/60 microcomputers and ES series computers comprise ASUTP gas transmission systems. Programs and data are designed for extensive use of user/computer-dialog methods and systems and unified SUBD [not further identified] data bases.

The ASUTP system controlling the Urengoy-Pomary-Uzhgorod, the Urengoy-Tsentra and the Yamburg-Yelets pipelines, the last of which is still in the design stage, integrates control functions of individual facilities (gas treatment facilities, KTs [not further identified] and compressor stations) into the entire gas transmission control system.

ORGANIZATIONAL AND TECHNICAL MEASURES ARE BEING IMPLEMENTED AND EQUIPMENT AND AUTOMATIC SYSTEMS OPERATING EXISTING COMPRESSOR STATIONS ARE BEING UPDATED BY

THE INSTALLATION OF REMOTE-CONTROL DEVICES. THE SPRINT-1 SYSTEM FOR THE COLLECTION AND PRELIMINARY PROCESSING OF DATA AND THE AVTOMATIKA-1 DATA/MEASURING CONTROL SYSTEM USING MICROELECTRONIC AND MICROPROCESSOR TECHNOLOGY HAVE BEEN DEVELOPED AND MANUFACTURED AND ARE CURRENTLY BEING TESTED.

Operational control coordination of regional and technological subsystems from unified gas supply system locations is provided by the upper-level control center, Central Dispatcher Control (TsDU).

The automated dispatcher control system (ASDU) operates at the TsDU level. It gathers operations, technological, planning and economic data from all gas-producing and gas-transmission associations in the industry. It processes, displays and prints out dispatcher data on pressure, gas throughput, and basic technological parameters at Unified Gas Supply System facilities and makes technological calculations for Unified Gas Supply System operational and scheduling purposes.

A NEW ASDU VERSION FOR A UNIFIED GAS SUPPLY SYSTEM IS BEING DEVELOPED, WHICH IS BASED ON THE STATE OF THE ART OF AUTOMATED CONTROL SYSTEM DEVELOPMENT THEORY, GAS INDUSTRY KNOW-HOW AND COMPUTER TECHNOLOGY. ITS EFFICIENCY WILL BE DUE TO TRANSITION FROM THE AUTOMATION OF LOCAL CONTROL TASKS AND SYSTEM-WIDE AUTOMATION OF CENTRAL DISPATCH CONTROL FUNCTIONS TO AN INTEGRATED UNIFIED GAS SUPPLY SYSTEM. The Unified Gas Supply System ASDU hardware includes a universal ES-1055 computer system, ES-1011 terminal computers for data collection, preliminary processing and display, remote VTS-56-100 terminals at data centers in the associations and ES-7927 displays for central dispatch control system users.

AT THE PRESENT TIME A PROTOTYPE OF THE NEW ASDU VERSION FOR UNIFIED GAS SUPPLY SYSTEMS IS IN EXPERIMENTAL OPERATION. IT IS A USER/COMPUTER DIALOG SYSTEM DESIGNED TO DEVELOP OPERATIONAL DISPATCHER GRAPHICS AND RECOMMENDATIONS ON HANDLING GAS THROUGHPUT IRREGULARITIES AND CONTROLLING THE DEVELOPMENTAL STAGES OF GAS TRANSMISSION SYSTEMS. This system provides an operational analysis of the increasingly complex situation in unified gas supply systems regarding gas resources and demand and the technical capabilities of fields, storage facilities and gas transmission systems. In addition, it calculates optimal throughput and distribution of gas by consumer category, optimal regimes of gas transmission systems and optimal planning for compressor station capacity and placing pipeline segments in service.

THE WORK THAT HAS BEEN DONE TO IMPROVE AND DEVELOP UNIFIED GAS SUPPLY ASDU AND ASUTP SYSTEMS FOR PRODUCING, PIPELINING AND DISTRIBUTING GAS FROM THE MOST REMOTE SYSTEM CONNECTIONS AND INTEGRATION INTO UNIFIED GAS SUPPLY ASU SYSTEMS SHOULD PROVIDE A TRANSITION FROM THE SOLUTION OF TASKS IN THE CONTROL OF INDIVIDUAL REGIONAL AND TECHNOLOGICAL SUBSYSTEMS TO A TOTALLY AUTOMATED UNIFIED GAS SUPPLY CONTROL SYSTEM.

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## OIL AND GAS

### DEVELOPMENT OF THE GAS INDUSTRY

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 6, Jun 85 pp 9-11

[Article by A.D. Sedykh, PhD Candidate, and A.I. Gritsenko, PhD in Engineering, All-Union Gas Scientific Research Institute: "Basic Trends in Scientific and Technical Progress in the Gas Industry." Passages in all caps are underlined in the original for emphasis.]

[Text] Scientific and technical progress in the industry is based on the goal method. Overall goal-oriented plans are formulated by the scientific and technical center, whose functions are defined by the All-Union Natural Gas Scientific Research Institute. Plans cover basic problems whose solution will speed up the development and implementation of progressive technical guidelines and greatly reduce outlays in labor, funds and materials required to achieve the planned levels of gas production.

The USSR gas industry is one of the most dynamically developing key industries in the fuel and power complex. To a great extent, it determines the technical progress and the pace of development of the entire national economy. The importance of natural gas as a raw material and as a fuel for industry and power generation is growing steadily. In the mix of power resource production, the role of gas is steadily increasing. Gas comprised 27.1 percent of basic fuels produced in 1980, and will comprise about 33 percent by the end of 1985.

The objective prerequisites for accelerating development of the gas industry have become complicated as a result of successful geological exploration, high gas production growth rates and increased extension of and energy investment in trunk gas pipelines. The role of scientific and technical progress is also great.

IMPORTANT PROBLEMS SUCH AS THE IMPROVEMENT OF MATHEMATICAL MODELING METHODS FOR THE DEVELOPMENT AND PRODUCTION OF GAS FIELDS, ENHANCING THE ULTIMATE GAS AND CONDENSATE YIELD OF RESERVOIRS, INCREASING GAS WELL PRODUCTION, INCLUDING WELLS IN LOW-PERMEABILITY ROCK AND INVOLVING GAS CONDENSATE FIELDS IN THE DEVELOPMENT OF LOW-PRODUCTIVITY OIL FRINGES ARE BEING SOLVED IN THE PRODUCTION OF GAS WITHIN THE FRAMEWORK OF OVERALL GOAL-ORIENTED PLANS.

Work is in progress to determine reserves and formulate recommendations on the utilization of non-traditional sources of gas related to zones of anomalously high reservoir pressures, coal-bearing basins, gas hydrate reservoirs and gas-saturated water flood systems.

Considerable attention is now being paid to development of methods of long-term estimation of gas production and the production of other commercial products using mathematical models, algorithms and programs taking the development of the raw material base into account, its structure, and relationship with existing transmission systems, optimal designs for the development of individual (base) fields and regional development.

An important trend in scientific and technical progress is the improved ultimate recovery of condensate production due to reservoir pressure maintenance, the production to depletion of condensate which precipitates as gas-condensate reservoirs are produced by the use of secondary reservoir drive methods and increasing condensate production percentages while treating gas. At multiple-zone gas-condensate fields, it is planned to raise gas condensate production by regulating gas production by field and by well to prevent premature water flooding of reservoirs and fluid squeezing.

A series of measures is being worked out at scientific research and experimental design organizations to improve methods for stimulating gas migration to wells and ways to produce wells. In the case of wells tailed into highly permeable traps, stimulation is related to declaying the area surrounding the well bore. In the case of wells tailed into low-permeability traps, the task will be to create a branched drainage system in the area surrounding the well bore by various methods (hydraulic fracturing, foam alcohol acid and alcohol acid treatment, in situ explosions, vibrowave processes, etc.).

OBJECTIVE FEATURES OF THE DEVELOPMENT OF GAS TRANSMISSION BY TRUNK LINES (CONCENTRATION OF GAS FLOW, INCREASING TRANSMISSION DISTANCES AND COMPLEX NATURAL AND CLIMATIC CONDITIONS) PRE-DETERMINE BASIC TRENDS IN THE IMPROVEMENT OF GAS TRANSMISSION TECHNOLOGY AND EQUIPMENT. FIRST, ENERGY AND METAL REQUIREMENTS MUST BE REDUCED AND THE PROPORTION OF LARGE-DIAMETER GAS PIPELINES MUST BE FURTHER INCREASED. EXTENSIVE IMPLEMENTATION OF GAS TRANSMISSION TECHNOLOGY AT 7.5 MPa PRESSURE, AND ENERGY-SAVING TECHNOLOGY AND EQUIPMENT ARE PLANNED. MUCH ATTENTION IS BEING GIVEN TO IMPROVING BOOSTER STATION FACILITIES, IMPROVING THEIR FUEL PERFORMANCE, IMPLEMENTATION OF TECHNOLOGICAL DECISIONS TO ACCELERATE THE CONSTRUCTION OF COMPRESSOR STATIONS, AND INCREASING THE RELIABILITY OF PIPELINES, COMPRESSOR STATIONS AND THE GAS SUPPLY SYSTEM AS A WHOLE.

An increase in the proportion of gas in the fuel and power mix of the country and an increase in the average diameter and throughput of gas pipelines will increase the detrimental impact of possible emergency shutdowns of gas pipelines and compressor stations on the national economy. In this respect, the first plan sets the task of improving the operational reliability of trunk gas pipelines. This task will be solved by using pipe made of new brands of steel with higher strength characteristics and pipe with factory-applied external insulation. Highly reliable automated cathode-protection systems and modern pipe defectoscopy units will be used extensively. Efforts will be made to improve the methods, resources and organization of repair services and to implement new technological pipe-welding processes.

Systems methods are being upgraded to provide not only economy and efficiency in the functioning of a unified gas supply system but also to increase its structural reliability and the interaction of various subsystems by utilizing

modern mathematical modelling methods and optimization utilizing powerful computers.

The Ministry of the Gas Industry has set itself the task of supplying fuel-quality compressed natural gas to the country's truck fleet. In this respect, prefabricated gas compressor and filling station designs (AGNKS) must be developed, and energy-saving gas compressor technology, economic pressurized gas-storage methods and a system for distributing gas to widely scattered consumers must be implemented. IN ORDER TO ORGANIZE EXTENSIVE PRODUCTION AND UTILIZATION OF A LIQUEFIED NATURAL GAS (LNG) IN SYSTEMS REGULATING GAS CONSUMPTION PEAK LOADS AT LARGE INDUSTRIAL CENTERS AND FOR USE AS A FUEL FOR TRUCKS, TRAINS AND BOATS, THE DEVELOPMENT OF SPECIAL TURBOCOMPRESSOR, HEAT-EXCHANGER UNITS AND CRYOGENIC FUEL TANKS AND LNG STORAGE TANKS MUST BE CONSIDERED.

In gas refining, the main task is to increase extraction of valuable components from gas while reducing the amount of energy required to do so. Efforts will be continued to accelerate existing gas-scrubbing methods with more extensive application of selective sorbents with improved thermophysical properties, and the amount of energy required to scrub gas and obtain sulfur will be reduced.

The process of obtaining sulfur by using efficient catalysts and new technical guidelines utilizing improved designs will be extensively implemented. Simultaneously pre-scrubbing installations for exhaust gases that can remove up to 99.9 percent of the sulfur will be implemented.

A LOW-ENERGY SCRUBBING PROCESS FOR HIGH-SULFUR GAS UTILIZING CONDENSATION AND PHYSICAL ABSORPTION, SCRUBBING TECHNOLOGY FOR LOW-SULFUR NATURAL GASES YIELDING SULFUR, AND A PROCESS FOR EXTRACTING THE PROPANE-BUTANE FRACTION AT LOW-TEMPERATURE FIELD SEPARATORS AND STABILIZING CONDENSATE ARE BEING DEVELOPED.

The industry has set up a strong scientific base, and is successfully performing research on basic trends in gas technology and improving the management of scientific and technical progress. Many problems are being solved with the scientific and technical cooperation of foreign countries.

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## OIL AND GAS

### NEW GAS-PUMP DESCRIBED

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 6, Jun 85 pp 10-11

[Passages in all caps are underlined in the original for emphasis.]

[Text] The last few years in the development of the gas industry have been marked by intense retooling of gas transmission facilities with new technological equipment. Enterprises related to the gas industry have developed booster units (GPA's) with a capacity of 16,000 and 25,000 kW, which are installed at compressor stations on such large gas-transmission systems as the Urengoy-Pomary-Uzhgorod and the Urengoy-Tsentr Pipelines I and II).

The basic technical and economic indicators of these units are compared with those of the GTK-10 unit in the following table.

Basic Technical and Economic Indicators of New Gas Booster Pumps

Indicators	Type of Gas Booster Pump			
	GTN-16	GPA-Ts-16	GTN-25	
Rated Capacity, 1000 kW	10	16	16	25
Heating Cycle	Recycling	Simple	Simple	Simple
Power Shaft rev/min, sec <sup>-1</sup>	80	108	88	61
Injector Feed, million m <sup>3</sup> /day	21.5	32	32.7	46
Weight Delivered, metric tons	154	120	160*	173
No. of Pumps per Compressor Station (working + reserve)	6+2	3+2	3+2	2+1
Percent Metal of Compressor Station	100	70	60	60
Labor Intensity of Compressor Station Construction	100	63	37	64

\*Complete delivery includes containers replacing buildings and systems.

New booster stations have been equipped with full-pressure booster pumps and have two types of drive: stationary 16,000-kW turbines manufactured by the Turbomotorny Zavod Production Association imeni K.Ye. Voroshilov and 25,000-kW turbines manufactured by the Nevskiy Zavod Production Association imeni V.I. Lenin and 16,000-kW converted aviation engines made by the KM [not further



identified] Production Association imeni M.V. Frunze. These turbines offer outstanding operating economy in the simple heating cycle and a design combining compactness with high efficiency.

The GTN-16, GPA-Ts-16 and GTN-25 units are set at zero data in separate buildings or open-air containers. Their design allows the construction of compressor shops using industrial methods and reduces construction labor requirements. The units are delivered for assembly in highly finished modules, i.e., each component module is installed, together with the other modules, as a complete assembly.

The use of full-pressure injectors maximized design simplicity of compressor station piping connections.

These booster units are automatically regulated and are monitored and controlled from a central location, assuring operation within proper parameters and remote operations with no need for round-the-clock service personnel.

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## OIL AND GAS

### NATURAL GAS REFINING

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 6, Jun 85 pp 12-13

[Article by V.M. Mishin, Engineer, and A.T. Shatalov, Candidate of Technical Sciences: "Natural Gas Refining Outlook." Passages in all caps are underlined in the original.]

[Text] The basic function of gas refineries in the system run by the Ministry of the Gas Industry is to treat gas for pipeline transmission and bring it up to the standards required by consumers.

Depending on the composition of the gas, hydrogen sulfide and organic sulfur compounds may be scrubbed out, and condensate, propane, butanes and helium may be extracted. In some areas, ethane is extracted from natural gas. Gas refineries also desalt and dehydrate gas and stabilize gas condensate.

The discovery of huge gas condensate fields producing highly sour gas over the last 20 years has seen intense development of primary natural gas treatment, which is now handling several tens of billions of cubic meters annually.

With the spread of gas production to regions in the Far North, gas refiners were given the task of producing motor fuel to meet local requirements.

Thus, the gas refining subsector produces a range of products including sulfur, ethane, propane, butane, stabilized condensate, helium, motor fuels, and dehydrated refined gas.

The main thing in gas treatment is the need for accelerated construction plans and placement in service of gas- and condensate-refining facilities to keep up with field development. This task will be met by expanding production lines, delivering pre-assembled equipment to construction sites and preparation of working drawings for secondary facilities before basic technical decisions are finalized.

Workers in the gas refining subsector are thus faced with the following tasks:

DEVELOPING NEW TECHNOLOGICAL PROCESSES REQUIRING LESS ENERGY, LOWER CAPITAL INVESTMENT AND REDUCED METAL REQUIREMENTS;

DEVELOPMENT OF STANDARDIZED PLANS FOR SECONDARY FACILITIES;

DEVELOPING NEW ENVIRONMENTAL PROTECTION EQUIPMENT THAT PRODUCES NO WASTE; AND  
DEVELOPING AND INSTALLING AUTOMATED IN-STREAM GAS ANALYZERS.

THE LOCATION OF PLANTS IN REMOTE, THINLY POPULATED REGIONS POSES THE ACUTE  
PROBLEM OF RAISING LABOR PRODUCTIVITY CONSIDERABLY.

The main approaches to the solution of this problem are as follows:

Increasing unit capacity of technological installations;

Complete automation of primary and secondary processes;

Designing certain buildings and facilities as integrated installations;

Locating several technical operations in one unit and thus reducing the number  
of units and improving compactness;

Installing pumps on open-air pads where the climate allows; and

Centralizing control of primary and secondary processes from a single control  
panel.

It should be pointed out that the custom of dividing primary and secondary pro-  
cesses lowers technical and economic indicators considerably. In developing new  
standards, it is necessary to reconsider this approach and integrate primary  
and secondary processes.

AS HIGHLY SOUR GAS FIELDS ARE DEVELOPED, GAS REFINERIES ARE BECOMING THE MAIN  
SUPPLIERS OF SULFUR TO THE NATIONAL ECONOMY.

SULFUR SHIPPING CAPACITY IS BECOMING A FACTOR WHICH LIMITS THE VOLUME OF GAS  
THAT CAN BE REFINED IN HIGHLY SOUR GAS PROVINCES. THE CHEAPEST AND LEAST LABOR-  
INTENSIVE WAY TO SHIP SULFUR IS BY LOADING IT INTO INSULATED TANKS IN LIQUID  
FORM. SINCE A NUMBER OF SULFUR CONSUMERS USE LIQUID SULFUR TO MAKE SULFURIC  
ACID, THIS SEEMS TO BE THE MOST PROMISING WAY TO SHIP SULFUR.

In order to resolve this task successfully, it is necessary to develop and uti-  
lize high-capacity insulated tanks holding over 100 metric tons and to pump  
liquid sulfur five to 10 km through electrically heated pipelines.

ONE OF THE PROMISING GAS FIELDS WHERE IT IS POSSIBLE TO BUILD A COMPLEX TO RE-  
FINE GAS AND CONDENSATE, PRODUCE SULFUR AND LIQUEFY GAS AND ETHANE IS THE KARA-  
CHAGANAK FIELD. It is currently being developed. In the last few years, plans  
have been made to undertake further construction to increase production and re-  
inject around 70% of refined gas back into the reservoir to maintain formation  
pressure and maximize condensate production.

The gas/condensate mix flows from producing wells through individual gathering  
lines to distributing manifolds at one of four gas treatment facilities.

Plans call for production heaters for producing wells. The heaters will be installed in a separate area near the wellheads.

Wellhead heaters maintain flowline temperatures and prevent the precipitation of solid paraffin and the formation of hydrates. Two lines are laid alongside each flowline: an inhibitor line to inject corrosion inhibitor at the wellhead and a refined-gas line to operate pneumatic wellhead equipment and provide fuel for the wellhead heaters.

The distributing manifolds shunt the gas/condensate production mix to the gas treatment installation, a metering separator or the field gas supply line.

The metering separator periodically measures the gas, condensate and water produced by each well.

The gas/condensate mix arriving at the gas treatment facility is dried and separated from the condensate by the low-temperature method. The low-temperature separation unit consists of three identical technological lines (one of which is a back-up line) which dries the gas to the water/hydrocarbon dew point (at least  $-10^{\circ}\text{C}$ ) at an intake pressure of 8 MPa.

Each technological line consists of the following:

First separation phase, where the liquid is separated from the gas;

Gas/gas recovery-type heat exchanger, where the gas is chilled (inhibitor is injected upstream of the heat exchanger to prevent the formation of hydrates);

Second separation phase, where the gas is further separated off and dried;

Heat exchanger to heat the liquid separated out in the first phase; and

A three-phase separator designed to separate formation water from hydrocarbon condensate.

AN AUTOMATED CONTROL SYSTEM, WHICH DOES NOT REQUIRE 24-HOUR HUMAN SUPERVISION, OPERATES THE INSTALLATION. A REMOTE DISPATCHER MONITORS AND CONTROLS THE INSTALLATION.

The mix of gas and unstable condensate is supplied to the gas refinery under its own pressure, where hydrogen sulfide is removed and the hydrocarbon condensate is refined.

Desulfurized gas is then piped to injection compressor stations where it is pressurized. Injection compressor stations are comprised of modules consisting of an electric multistage centrifugal injector, a filter/separator to dehydrate the gas upstream from the injector and an air-cooled unit to chill the compressed gas.

In high-pressure lines, gas flows from the injection compressor station through the distributing manifold to injection wells where it is reinjected into the formation.

IN BUILDING FACILITIES AT THE KARACHAGANAK FIELD, SPECIAL CONSIDERATION WAS GIVEN TO ENSURE RELIABLE PRODUCTION AND ENVIRONMENTAL PROTECTION.

Production wells are equipped with three safety features: a remote-controlled wellhead safety valve, an automatic master gate valve and automatic wing valves. Equipment, pipelines and fittings exposed to sour fluids are manufactured of materials which are resistant to hydrogen sulfide.

Each unit handling sour fluids at pressures above 0.07 MPa are equipped with two safety valves.

AN AUTOMATIC CENTRALIZED INHIBITOR SUPPLY SYSTEM FOR WELLS, FLOWLINES AND GAS TREATMENT UNITS, UTILIZING MULTIPLUNGER METERING PUMPS, IS PLANNED TO PROVIDE PROTECTION FROM CORROSION CAUSED BY MOIST CARBON DIOXIDE.

A system is also planned that can monitor the extent of corrosion in pipelines and other equipment by taking samples, verifying the presence of a film of inhibitor, and using control specimens and electric-resistance and hydrogen probes.

All technological units will be drained into sealed drainage systems, eliminating spillage on facility grounds.

TO PREVENT THE ESCAPE OF HYDROGEN SULFIDE INTO THE AIR, THE CONTENTS BLOWN OUT OF ALL UNITS UNDER REPAIR AND THE EXHAUST FROM ALL SAFETY VALVES WILL BE PIPED TO AN ENCLOSED FLARE.

A system is planned to detect hydrogen sulfide and other toxic substances in the air. The system would give an alarm indication when concentration levels exceed acceptable health standards.

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## OIL AND GAS

### RECYCLING GAS AT COMPRESSOR STATIONS

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 6, Jun 85 pp 18-19

[Article by P.M. Muzhiliivskiy, candidate of technical sciences, Yu.N. Vasil'yev, PhD of technical sciences, and L.S. Zolotarevskiy, candidate of technical sciences, Ministry of the Gas Industry, All-Union Gas Scientific Research Institute: "AN INTEGRATED SYSTEM FOR UTILIZING WASTE ENERGY." Passages in all caps are underscored in the original.]

[Text] The authors have devised an integrated system for utilizing waste energy at gas-turbine compressor stations which is designed to make use of all by-products. Use of this system throughout a 3,000-km 1420-mm gas pipeline with 40-MW compressor stations would save up to a billion cubic meters of natural gas annually.

The gas industry is ranked second among the various industrial ministries in gas consumption to meet its own needs. Its main consumers are gas transmission facilities and equipment, particularly gas-turbine and reciprocating booster stations, which account for over 80 percent of all booster stations. The problem of improving gas utilization efficiency at compressor stations thus acquires special significance.

Scientific research institutes of the gas industry and power equipment manufacturing enterprises are successfully resolving this important problem. The industry has laid down two tasks: (1) raising fuel efficiency at booster stations and (2) increasing the utilization of by-products of booster operations at compressor stations.

It should be pointed out that the second task should logically complement the first, even at thermodynamically advanced booster stations.

The first task involves developing and installing a new generation of high-efficiency gas-turbine and reciprocating booster pumps such the GPA-Ts-16 and the GTN-16, with efficiency ratings of 28 and 29 percent, respectively, the GTN-25 (29 per cent) and the MK-8, DR-12 and MKS-12 (36, 38 and 40 percent, respectively). Installation of these units will yield significant fuel gas savings at compressor stations.

Significant gas savings at compressor stations will also be achieved by solving the second task, utilizing secondary energy resources, including waste energy at booster stations.

A review of experience with the development and installation of systems for utilizing waste products at compressor stations in the USSR and abroad, in conjunction with an estimate of the magnitude of such waste indicates that of all waste products, only heat from booster pump exhaust is being utilized. HOWEVER, RESEARCH AND DESIGN EFFORTS AT THE ALL-UNION GAS SCIENTIFIC RESEARCH INSTITUTE HAVE SHOWN THAT AT COMPRESSOR STATIONS EQUIPPED WITH GAS-TURBINE AND RECIPROCATING PUMPS, WATER DISTILLED FROM THE EXHAUST, MECHANICAL ENERGY AND COLD FROM THE COMPRESSED-GAS TURBOMOTOR WHEN FUEL GAS IS REDUCED AND CARBON DIOXIDE FROM THE EXHAUST CAN BE EFFICIENTLY USED IN ADDITION TO HEAT. MOREOVER, TOTAL UTILIZATION IS POSSIBLE AND WILL MEET NOT ONLY COMPRESSOR STATION NEEDS, BUT ALSO SOME AGRICULTURE AND INDUSTRIAL PRODUCTION NEEDS.

As shown in the drawing, the authors' integrated system for utilizing waste products at compressor stations equipped with gas-turbine pumps is designed to utilize booster pump exhaust heat, distilled water, carbon dioxide and any fuel gas surplus pressure. Compressed gas is cooled in a special heat-recovery refrigeration system which yields a 17 to 20 percent fuel saving compared to booster stations with conventional-compressed gas refrigeration units.

Exhaust from a gas turbine (3), cooled in a regenerator (9), is fed into a recycling boiler (15) designed to provide hot water for heating and simultaneously produce steam for two purposes (for injection into the gas-turbine combustion chamber (7) and powering a generator (20) to produce electricity.

Distilled water obtained from exhaust gases in a special condenser (19) is supplied to the recycling boiler (15), where the exhaust is pre-cooled. The system contains a reservoir (18) for collecting the distilled water and replacing water lost in the steam loop. This reservoir can also supply water to the axial compressor air scrubber (6) to cool recycled air by internal evaporation.

After the water is distilled from exhaust gases, a fan (16) moves the gases through a gas/air mixer (17). The gas/air mixture is used to culture chlorella.

Coiled surfaces of economizers are designed to heat water to 70 to 130°C to supply the recycling boiler's hot water requirements. Hot water is fed into the boiler (14), where water is heated to meet consumers' heating and hot water needs. The system provides hot water in three temperature ranges: 90-95°C for greenhouses and service areas; 60-70°C for hot running water; and 20-25°C for irrigation.

A power unit consisting of a steam turbine (5) and a generator (20) provides electricity for rural and industrial consumption in addition to supplying the needs of the compressor station itself.

Fuel gas from the trunk pipeline is supplied through a recovery heat exchanger (3) to a compressed-gas turbomotor (2), where it expands. The turbomotor is linked to a worm-type compressor (4) and an emergency generator (1) by a common shaft. The cold thus obtained is used in the compressor station air conditioning system.





$t_6$ , which is the same as its initial temperature,  $t_1$ . At this temperature, the gas is reintroduced into the pipeline for transmission to the next compressor station. This compression and cooling cycle is then repeated.

A TECHNICAL AND ECONOMIC STUDY OF THE PERFORMANCE OF THIS INTEGRATED SYSTEM FOR UTILIZING WASTE ENERGY PRODUCTS ON ONE OF THE NORTHERN GAS PIPELINES DEMONSTRATED THAT NATURAL GAS SAVINGS OBTAINED BY THIS SYSTEM WERE DUE TO THE MORE EFFICIENT UTILIZATION OF GAS AT THE UNIT AND ELIMINATION OF THE GAS REFRIGERATION FACILITY POWERED BY STEAM-COMPRESSOR-OPERATED COOLING UNITS.

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## OIL AND GAS

### PROGRESS IN BURNING GAS

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 6, Jun 85 pp 21-22

[Article by K.N. Zvyagintsev, Candidate of Technical Sciences, Soyuzpromgaz All-Union Scientific Production Association: "Technical Progress in the Area of Gas Combustion." Passages in all caps are underscored in the original.]

[Text] Factors which determine the technical progress and condition the efficient combustion of gas at industrial and power generating plants are: strict compliance of burner design to technical specifications and equipping gas-combustion equipment with heat-utilization devices and automatic equipment. Implementation of these factors is achieved by developing and manufacturing the proper equipment and by performing tests on burners. Results of these tests will yield recommendations on optimizing equipment operations and removing equipment from service which does not meet requirements.

During the 11th Five-Year Plan, enterprises and other organizations at the Ministry of the Gas Industry have been involved in a large effort to develop new designs for burners and gas- and heat-utilization equipment, improve industrial capabilities for manufacturing this equipment and promote testing facilities.

Initiation of operations at the first units of GMGUIGA's [not further identified] Fastovskiy Factory has almost doubled the production of burners, radiation tubes, heat generators and other equipment for machine-building and metallurgical enterprises, the refractory industry, the construction materials industry, gas industry facilities, etc. Two support centers for testing burners used in the ferrous-metal industry and electric power plants have been organized.

Soyuzpromgaz, in conjunction with other enterprises and scientific, technical, planning and design organizations, is developing an extensive program for the development of new, high-efficiency gas- and heat-utilization equipment.

Of new developments showing the best results, infrared gas burners with metal-grid radiators should be mentioned. They are more reliable than burners with ceramic radiators. These burners will be widely used in various technological processes requiring heating by radiation and portable heating facilities. The infrared burners are injection-type burners which burn liquefied gas vapor. These burners are rated at 12.5 kW. GMGUIGA's Fastovskiy Factory manufactures the burners.

Type GS burners, using the gas self-carburizing principle, require less metal to manufacture. Basically, in order to accelerate gas self-carburization and increase radiation output, the main axial gas stream of gas at the intake is shielded by a supplementary coaxial stream of combustion products from the outer oxygen diffusion of the main air stream. Fig. 1 is a schematic of the type GS burner. The primary gas stream feeds in through the gas nozzle (1) and the secondary gas stream feeds in through a nozzle along the axis of the mixer (2). Additional air is supplied to the mixer around the periphery of the nozzle. The air/gas mixture flows from the mixer to the reservoir (3) and in several streams through orifices in the combustion stabilizer (4) into the annular space between the main gas stream and the walls of the tunnel, where it is burned in microjets. The burner's heat rating is 0.65 to 3.5 MW. It weighs 10.5 kg.

It is known that considerable fuel savings can be effected by using exhaust heat to warm up combustion air. Several different designs of heat recovery units are used. In recent years, heat-recovery burners incorporating a burner, a heat recovery unit and an exhaust pipe in a single-body design have been very popular in the development of heat-recovery technology. The use of heat-recovery burners also helps reduce metal and material requirements of furnace units. It has been shown that installation of heat-recovery burners in a furnace reduces the total volume of the recovery unit and hot-air piping by 10 percent. In terms of design, heat-recovery burners are divided into heat recovery/burner units and burners with built-in recovery units.

Fig. 2 is a line drawing of a 160-kW heat recovery/burner unit. This unit warms the air to about 360°C. One of its distinctive features is that this heat-recovery unit and burner can be adapted to furnace design.

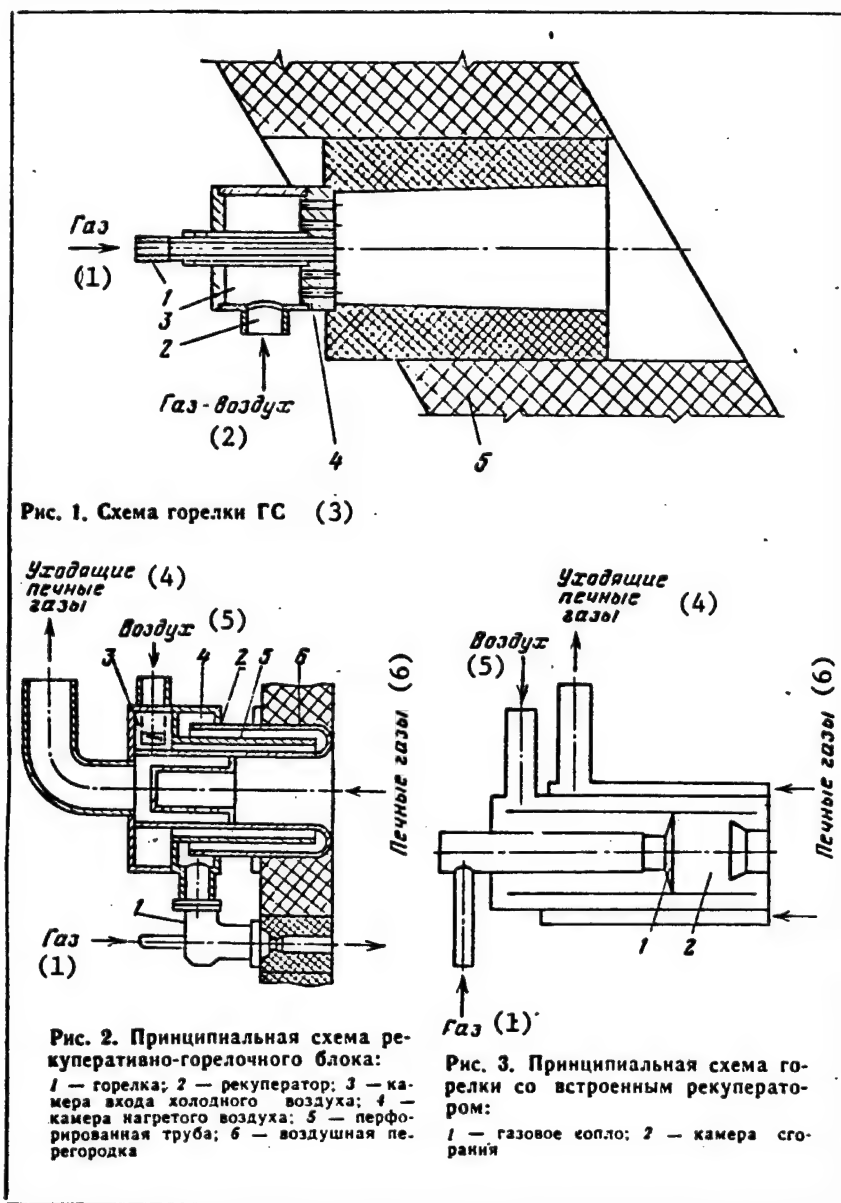
Fig. 3 is a line drawing of a 140-kW air-cooled burner with a built-in heat-recovery unit which warms the air to about 350°C.

One of the basic trends in the approach to the task of reducing gas consumption and operating costs is to equip burner facilities with remote-control, automatic regulating and safety features. Automation of gas-burning units provides: (1) gas savings by matching gas consumption with technological process requirements and maintaining the optimal gas/air consumption ratio; (2) safe and fast remote ignition of burners; (3) continuous monitoring of parameters determining operational safety of the burners and the entire unit throughout the production process; and (4) reduction of personnel and time required to monitor and regulate burners.

A significant trend in today's technology is the development of units containing a blast burner, an autonomous fan and a full complement of automatic features, unified into a single, highly compact unit, fully assembled and tested at the factory. This design requires no external air supply and the entire unit can be quickly and easily installed at a gas-burning facility. At the present time, Soyuzpromgaz enterprises are mass producing the 100-MW L1N units, which are in extensive use in heating boilers and other facilities.

Soyuzpromgaz and its Central Asian affiliate, the All-Union Scientific Research Institute for the Gas Industry, are now developing automated gas burners to

convert liquid-burning heat engines to gas.



1. Gas  
2. Gas/Air

3. Fig. 1. Type GS Burner  
4. Furnace Gas Exhaust

5. Air  
6. Furnace Gases

Fig. 2. Heat Recovery/Burner Unit

1. Burner. 2. Heat Recovery.  
3. Cold Air Intake. 4. Heated Air.  
5. Perforated Pipe. 6. Air Deflector

Fig. 3. Burner with Built-in Heat Recovery

1. Gas Nozzle. 2. Combustion Chamber

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## OIL AND GAS

### TYUMEN JOURNALIST CITES OBSOLETE OIL DRILLING EQUIPMENT

LD311534 [Editorial Report] Moscow Domestic Service in Russian at 0900 GMT on 31 October carries a 7-minute report by Tyumen journalist Yelena Babina on the need for new drilling equipment in the north in which she says: "We have long been talking about the need to build new machinery for the north; I recall a hook-up on all-union radio in 1980, when representatives of the Volgograd plant producing drilling equipment promised not only to think about the northerners, but also to take a more decisive step: to take the obsolete BU-75 drilling rigs out of production and replace them with the powerful 2500-EUK rigs which are more suitable for western Siberia. However, the rigs which were supposed to be dropped continued to arrive and are still arriving in western Siberia, at Samotlor. Sometimes one is offended at the thought that these rigs are convenient only for the manufacturers. Drilling chief Anatoliy Dmitriyevich Shakshin, a hero of socialist labor, has said that the Samotlor drillers' equipment has not been changed in 20 years."

Babina presents the comments of other drilling chiefs from Nizhnevartovsk. They say the BU-75 has to have parts added after it arrives; the new rigs arrive fully equipped, which saves time and effort, and have more efficient hydraulic equipment. The drilling chiefs complain that there is also a lack of repair equipment, and they have to operate heavy tools by hand. "The scientific-technological revolution has not arrived here, one is sometimes even offended that elsewhere there are program-controlled machine tools being introduced, robots and robot technology, but we have none of this."

Babina asks Aleksandr Nikiforovich Voyevoda, head of the production department for rig construction and drilling (?preparation) work of Glavtyumenneftegaz, about the issue. The management is concerned about this as well, he says, and in particular the modernization of rigs in Nizhnevartovsk. "There is no doubt, we have to say that we have had delays in the matter, and quite prolonged ones, because, for instance, the 2500-EUK was supposed to go into production at the same time as the 3000 drilling rig, but the start of serial production was delayed, and it is only just beginning. I think that we will be able to replace the stock of drilling rigs at Samotlor with rigs of the 2500-EUK class in the course of 3 years. Perhaps we will be able to create other drilling rigs in this time and bring them in. At any rate,

we have drawn up a program together with the Volgograd drilling equipment works for building direct-current drilling rigs with (?insulated) drive, so there will be other drilling rigs".

Babina concludes "The machinery with which the drillers are equipped today is obsolete. New and higher drilling rates will only come with modern equipment; it is time for serial production; it is time to open up the road to Samotlor for new machinery."

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## OIL AND GAS

### CONSTRUCTION DEVELOPMENTS IN WESTERN SIBERIA

Moscow EKONOMICHESKAYA GAZETA in Russian No 17 Apr 85 p 8

[Article by V. Voznyak: "On the Construction Sites of the Oil Fields"]

[Text] In the current year work on-site construction of oil fields in Western Siberia has increased. The objective set is to compensate to the maximum extent for the delay incurred since the start of the Five-Year Plan. Previously tapped deposits are being developed, and oil-gathering systems are being installed, plus temporary pumping stations, oil-refining equipment, intra- and interfield pipelines, gas-collecting systems for the transportation of the intransit natural gas, electricity power lines, and substations. Moreover, group pumping stations are being built with a system of high and low pressure water carriers for pumping water into oil-bearing layers to increase oil flow, as well as special compressor stations with gasline systems for gaslift oil recovery.

Fifteen new oil fields are scheduled to be developed in 1985. In the start-up complex of each one of these, there is as a rule a group residence for the on-site staff and many of the aforementioned construction site units. Acting in the capacity of principal subcontractor is Minneftegazstroy [Obshchesoyuznoye ministerstvo stroitelstva predpriyatiy neftyanoy i gazoyoy promyshlennosti SSSR; USSR Ministry of Construction of Petroleum and Gas Industry Enterprises]. Its central directorates are major players: Glavtyumenneftegazstroy and Glavtyumentruboprovodstroy as well as the "Sibkomplektmontazh" association and a host of specialized assembly subdivisions. These organizations are strongly supported by managers, technical and material resources with an enhanced program of projects for the current year.

Twenty-two complete technical production lines from 14 construction-assembly trusts from Minneftegazstroy are being additionally relocated to Western Siberia from other regions of the country for installation of the pipeline. Several thousand highly qualified welders, insulators, and construction machine operators have come to the oil regions of Tyumen oblast. The well-organized logistical work in the redeployment of these subdivisions made it possible in January and February to expand operations on a broad front in the majority of planned facilities.

The coordinated actions of the construction organizations of Minneftegazstroy, as well as the greater attention paid by the Ministry of the Petroleum Industry to outfitting facilities with equipment, brought about great results in the first quarter despite the harsh weather conditions. The quarterly plan for construction and assembly projects was overfulfilled. More oil sites and pipelines were activated than were planned for that period.

For the combined period of January-March three oil-refining facilities were opened, 11 temporary and branch pumping stations started up, plus more than 700 km of pipelines, 80,000 m<sup>3</sup> of reservoir capacity, around 300 km of power lines, and a host of other production facilities. Three new oil deposits were opened up instead of the two planned starts. The organizations of Glavtyumenneftegazstroy (headed by M. Chizhurskiy) have worked hard. The recruited subdivisions Glavtruboprovodstroy (headed by I. Mazur), Glavvostoktruboprovodstroy (headed by F. Mukhamedov), Glavuzhtruboprovodstroy (headed by N. Zhukov) and Glavukrneftegazstroy (headed by S. Kindrat) have overfulfilled the stated objectives for construction and assembly activity. The fast pace was maintained on oil deposit sites in April. Many collectives had remarkable results in the pre-May competition, fulfilling their obligations in commemoration of the 40th anniversary of the victory of World War II.

It must be noted that while the construction crew of Minneftegazstroy has made a successful step, it is but a first, preliminary step towards fulfillment of this year's intensive program. The tasks of the second quarter are more intensive compared to those of the previous quarter, especially in terms of start-up of productive capacities. The pace of the activities on linear construction must therefore be increased in the future.

Foundation work on platform sites must be completed in the days remaining until the mud season blocks the roads. The client-enterprises must also resolve important matters, namely delivery of equipment to construction platforms, carrying out of start-up work, training of managerial staff, and the rapid assimilation of capacities.

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## OIL AND GAS

### NEW EQUIPMENT FOR OIL WORKERS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 14 May 85 p 1

[Article by N. Batalov: "Technology for Oil Workers"]

[Text] What should oil-drilling technology be? Last June this question was discussed in Baku at a meeting of the country's oil workers and machine builders organized by "Sotsialisticheskaya Industriya." It was noted, in particular, that the machine builders owed a great debt to oil workers. What is the state of the art now in technology that would allow a quicker and more efficient extraction of the natural riches of underground repositories?

Two facilities can be seen to the right of a concrete structure. They are not at all attractive on the outside. Only a specialist would note that they are located unusually close to the chain of oil wells. Such buildings are usually not found on the well sites.

V. Ioffe, team leader for installation of hydropiston pump facilities for oil recovery, explains:

"In order to extract oil from wells in the country's oil fields, sucker-rods and electrocentrifugal pumps are used. Both are required at precise intervals for repair work. Thousands of people work exclusively on bringing them to the surface and replacing them with repaired units. To carry out this operation the well must be stalled by means of a special solution. As experience shows, this harms the oil-bearing layer: after several stoppages the well characteristics decline and we get less oil.

"The underground repair crew is not needed to change the hydropiston pumps. Two operators within two hours can trip it up to the surface and replace it with a new one without stopping the well. I would note that under the conditions of Western Siberia an entire crew will spend no less than 40 hours of work time repairing a well that is equipped with the traditional pumps.

"How does the new facility function? After thorough purification by power pumps, a portion of the oil extracted from below goes into the well and engages the hydropiston pump inserted in it. The facility can service up to eight functional wells simultaneously.

"Does that mean that similar major facilities will have to be built everywhere?

"Bear in mind that this is a test facility. We need it for experiments among other things. When it is implemented on a widespread scale it will be done on the basis of the needs of the industry."

It is necessary to work out a number of things in order to implement a new technique of mechanized oil recovery on the fields of Western Siberia. Kollektivs have an important role to play in the enterprises, where technical equipment, whose quality must be flawless, is prepared in accordance with the orders of the designers. Unfortunately, there are still a fair number of pretentious claims made about the production of the Sveskiy pump plant and the "Salavatneftemash" organization. It is up to them as to how quickly the country's facilities will become widely registered for oil fields.

Now A. Kutoviy's assembly crew from the oil and gas recovery directorate "Surgutneft'" is completing work in preparation for testing of the country's first hydropiston pump facility. The workers of the Western Surgut deposit will soon receive the technology which will enable them to recover oil faster and with minimal waste.

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## OIL AND GAS

### BRIEFS

**KARCHAGANAK DEPOSIT**--The Karchaganak deposit has proceeded to the first stage of testing and industrial development. Now the UKPG refinery and condensate lines to the Orenburg refinery are operational. Construction of wells and the experimental refinery, automobile roads, the gasoline, and other on-site facilities has been completed significantly sooner than planned. A large chemical complex is to be built in the future on the site of the deposit. [By A. Trutnev] [Text] [Moscow GAZOVAYA PROMYSHLENNOST in Russian No 2 Feb 85 p 13] 12912/13046

**CHUKOTKA FUEL**--Geologists predictions of marketable quantities of blue gas on Chukotka Island have been confirmed. In the Anadyrsk lowlands, after geophysical experiments, a strong gush of gas condensate began to "babble" immediately from the three underground layers of Well 1. [By A. Trutnev] [Text] [Moscow GAZOVAYA PROMYSHLENNOST in Russian No 2 Feb 85 p 13] 12912/13046

**SAMAN-TEPE SITE**--Many years of experience developing gas deposits in the desert have helped the Turkmenneburgaz collective determine the initial facilities for the Saman-Tepe field. Among the first sites activated were the first two complexes of the Pioneer Center for Economic Drilling. They both have a group residence with dormitories, a store, dining room, bath-house, and boiler-house. Also being built there are the depot for hot lubricants, the pipe repair and mechanical repair workshops with a machine service center. Technical facilities are being built on the site simultaneously with the housing settlement. The Saman-Tepe gas, with a high content of sulfur compounds, will go to the Mubarekskiy refinery in order to permit full utilization of the new deposit. [By A. Trutnev] [Text] [Moscow GAZOVAYA PROMYSHLENNOST in Russian No 2 Feb 85 p 13] 12912/13046

**SEYRAB GAS**--Gas recovered from the Seyrab site in the Central Karakumy has begun to flow into the mainline Central Asia-Center. The gas-site construction crews in the Karakumy are working under difficult conditions: everything must be brought here from hundreds of kilometers away. And yet the development of Seyrab was done in a short time frame. The problem is that a "clump" of deposits has been discovered in the Central Karakumy. The first of those developed was the Uch-Adzhi. Gas from Seyrab flows to the refinery built here, where it receives preliminary treatment for impurities. Development of the Eastern Uch-Adzhi deposit is also planned. [By A. Trutnev] [Text] [Moscow GAZOVAYA PROMYSHLENNOST in Russian No 2 Feb 85 p 13] 12912/13046

BABAARAB WELL--The Babaarab well has yielded industrial gas. Development of the new long-term gas deposit in Turkmeniya has begun. [By A. Trutnev] [Text] [Moscow GAZOVAYA PROMYSHLENNOST in Russian No 2 Feb 85 p 13] 12912/13046

WESTERN DZHURAMERGEY PLATFORM--Drillers from the industrial association "Turkmensevburgaz" have arrived at the new drilling platform. Two wells have started flowing, and the planned depth of each exceeds 4,000 m. [By A. Trutnev] [Text] [Moscow GAZOVAYA PROMYSHLENNOST in Russian No 2 Feb 85 p 13] 12912/13046

EVERYONE CONTRIBUTES--The metal construction and reinforced concrete products factory "Azglavenergo" has recently indicated that they have fulfilled the delivery plan for the 5 months of 1985 to date. More than 800 m<sup>3</sup> of wooden support beams and over 150 tons of metal products have been produced and directed to consumers over plan. The growth target of labor productivity and other technical-economic indicators has been overfulfilled. The enterprise has attained this success through the skill of its workers, many of whom have been working at the plant for over 20 years, mastery of technical production processes, strengthening of worker discipline, and widespread socialist competition. [By A. Gaziyeu] [Text] [Baku VYSHKA in Russian 30 May 85 p 1] 12912/13046

YAMBURG-ELETS LINE--The first junction point on a 200 km portion of the Yamburg-Elets gasline, which goes through Udmurtiya, has been welded ahead of schedule. [Text] [Moscow EKONOMICHEskAYA GAZETA in Russian No 13 Mar 85 p 3] 12912/13046

SOVETABADSKOYE DEPOSIT--First-phase assembly of gas refinery facilities in the very large Sovetabadskeye gas condensate deposit in the Southern Karakumy of Central Asia has been completed. [Text] [EKONOMICHEskAYA GAZETA in Russian No 14 Apr 85 p 3] 12912/13046

DRILLING AT KOMI--Drilling at the autonomous republic's deepest exploratory well is being carried out at the Vuktylskoe gas deposit. This pace-setting crew, headed by Ivan Glinskiy (Directorate of Exploratory Drilling of the "Komigazprom" association), must reach gas-bearing layers at a depth in excess of 6,560 m. They have already gone down more than 5,000 m. Photo: low-depth drilling rig number 58; I. Glinskiy. [Text] [Komi ASSR EKONOMICHEskAYA GAZETA in Russian No 14 Apr 85 p 4] 12912/13046

SURGUT AND URENGA DEPOSITS--The eastern Surgut oil deposit (Tyumen Oblast) has entered its industrial phase. The first tons of crude have begun to flow into the intrafield pipelines. The eastern Surgut oil deposit is one of 15 to be developed this year. A portion of the mainline of Urenga-Center 2, between the village of Ord and the town of Chaykovskiy (Permtoblast) is ready to pump gas. Testing has been completed in whole. [Text] [EKONOMICHEskAYA GAZETA in Russian No 16 Apr 85 p 2] 12912/13046

GEYSER STRUCK AT CHARDZHOU--The intensive labor of many months on the part of drillers headed by drilling expert A. Khanymkulov of the "Turkmensevburgaz"

industrial association has culminated in a strong gas geyser's rising from underneath the Karakumy. This has confirmed geologists predictions that the Balkui well, on an old caravan trail, contains high gas-bearing layers. [By S. Kim] [Text] [Chardzhou SELSKAYA ZHIZN in Russian 19 Apr. 85 p 1] 12912/13046

UNDERWATER DRILLING AT VOLGOGRAD--For the first time in the country's history, at the Volgograd drill equipment plant, a complex for underwater wellhead equipment on floating rigs, intended to tap oil and gas wells up to 5,000 m deep at an ocean depth up to 200 m, has been perfected. The annual economic impact of implementation of this complex exceeds 12 million rubles. [By I. Mordvintsev] [Text] [Volgograd SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 May 85 p 2] 12912/13046

NURLAT OIL EXTRACTION--Oil extraction workers of the workers' settlement Nurlat of the Tatneft Association have fulfilled their 5-year plan plan for oil extraction in the past 24 hours. Around 3 million tons of raw material has been dispatched from here to petrochemical enterprises. [Summary] [Moscow Domestic Service in Russian 0600 GMT 20 Sep 85 LD] /6662

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#### DEVELOPMENT, PROSPECTS FOR EKIBASTUZ PRODUCTION OUTLINED

Moscow UGOL in Russian No 8, Aug 85 pp 46-49

[Article by S.P. Kurzhey, engineer, Ekibastuzgol Association: "Prospects for the Development of Ekibastuz"]

[Excerpts] The Ekibastuz basin plays an important role in the country's fuel balance. The foundation of the fuel and energy complex being created with it as a base is the Ekibastuzgol Association's open pit mines, which are the largest in the branch.

The most important assignments for all the association's labor collectives in the 11th Five-Year Plan are an improvement in production efficiency, insuring an increase in coal extraction volumes, and accelerating technical progress.

The great organizational work of economic, party, trade union and Komsomol organizations for the implementation of organizational and technical measures is furthering the achievement of high results.

Production capacities for the extraction of coal reached 73 million t, including 51 million t at the Bogatyr Pit. The average annual increase in coal extraction was 3.2 percent in 1983-1984. The amount of stripping work increased by 16.7 percent.

Special attention is being given to improving production efficiency and the rational use of equipment and material and labor resources. As a result, the average annual productivity of rotary bucket excavators for the extraction of coal is now 3,708,000 t. The load on stripping excavators rose to 1,459,000 m<sup>3</sup>, and the productivity of locomotive-pulled cars for the transportation of stripped rock increased from 732,000 to 808,000 m<sup>3</sup>.

The technical re-equipping of the pits is continuing. At the present time, the association's excavator fleet includes powerful ERShRD-5000, SRs(k)-2000, ERP-2500, ERP-1250, ER-1250 and SRs(k)-470 rotary bucket extraction complexes; EKG-12.5 stripping excavators with bucket capacities of 12.5 and 16 m<sup>3</sup> and EKG-6ZU, EKG-6ZUS and EKG-8I units with bucket capacities of 6 and 10 m<sup>3</sup>; ESh-10/70 and ESh-13/50 draglines are used extensively for piling. Coal and stripped rock are transported by OPE-1 and PE-2M traction units, TE-3M diesel locomotives, and electric locomotives in large-capacity 2VS-136, VS-180 and

VS-105 dump cars. More than 150 units of different types of road equipment are in operation at the pits, as well as 120 bulldozers, 80 drilling machines and 110 powerful cranes that travel by rail or on tires.

Additional exit trenches have been dug at some pits in order to reduce the distance for the transportation of stripped rock and disperse the flows of overburden and coal, as well as to reduce the labor-intensiveness of stripping work. The height of the existing piles has been increased to 50 m, and a second fill stage 30 m tall is being formed with ESh-10/70 and ESh-13/50 walking excavators. Additional exchange points for locomotive-pulled stripping cars have been introduced at the Stepnoy and Severnyy pits; the receiving capacity of the piling sidings has been increased by more than 8 million m<sup>3</sup>.

At the Bogatyr Pit the SRs(k)-470, ER-1250 and ERP-1250 excavators, which have small linear parameters, have been replaced with SRs(k)-2000M excavators, which have a large number of buckets and a strengthened crusher design. As a result, at these faces the loading of small pieces has been completely eliminated and effective averaging of the coal directly during the operating process has been insured.

The equipping of the ERP-1250, ER-1250 and SRs(k)-470 excavators with a centrifugal rotary wheel expanded the area of their utilization in the working of stone coal because of an increase in the specific cutting power, a reduction in the dynamic loads on the excavator, and a reduction in the size of the lumps of coal.

OPE-1 and PE-2M traction units continue to be introduced at the pits. In order to improve the effectiveness of utilization of railway transport, the contact network is being renovated and converted to 3.3 kV. Provisions have been made to use R-65 rails and metal crossties, lay movable tracks on a gravel base, and enlarge the railway transport repair base.

Mining and transportation equipment maintenance has been improved. A centralized maintenance system has been created for excavators, OPE-1 traction units and DET-250 bulldozers; a shop for the repair of rolling stock has been put into operation at Trudovaya Station.

The technical re-equipping of the pits and rational technology for the conduct of extraction work made it possible to raise the specific share of coal extraction by rotary bucket excavators at the Bogatyr Pit to 92.3 percent, and the figure for the association as a whole rose to 89.3 percent.

The equipment and technology for drilling and explosives work is constantly being improved. At the present time, highly productive 2SBSH-200N and SBR-160 drilling machines and MZ-3 and MZ-4 charging machines are being used effectively in the pits.

An order has been introduced for the advance determination of the quality of coal being dug directly at the face, on the basis of data from bed samples and the determination of the percentage of coal while it is being transported. This sped up wagon turnover and reduced labor expenses for the taking of goods samples.

Aerial photographic surveying produced with the newest domestic and foreign equipment is used to improve the effectiveness of the control of mining operations. Monthly and daily-weekly production schedules for stripping and blasting work have been developed and introduced. The introduction of rational extraction processes and a coal quality control system provided a 1.1 percent reduction in operational losses of coal.

At the present time, the Ekibastuzugol Association's pits are providing 10.6 percent of the coal extracted by the branch and 26.1 percent of that extracted by the open pit method. Every day 210,000-220,000 t of coal is shipped to consumers. In 1984 the association fulfilled its coal extraction plan by 100.6 percent, mining 75.6 million t as against the planned figure of 75.1 million t. Labor productivity increased by 1.4 percent, and the production cost for extracting one ton of coal decreased by an additional 0.6 percent. Worker labor productivity for the extraction of coal at the Bogatyr Pit reached 3,647.6 t/month.

Production capacity for the extraction of coal has reached 104.1 percent, including 106.8 percent at the Bogatyr Pit. The amount of coal extracted at the pit increased by 1 million t in 1984 because of the assimilation of capital investments for stripping and preparing new levels.

At the same time, the mining and transportation equipment is still being used insufficiently effectively. Extended unplanned work stoppages are taking place. This is related, in the first place, to the constantly increasing depth of the workings, complication of the layouts of the transportation lines to the dumping drops, and an increase in the distance to which the coal and stripped rock must be transported, and in the second place, to an inadequate level of mechanization of auxiliary operations (particularly in railway transport) and a lag in the development of the repair base for the mining and transportation equipment.

In the last 5 years alone the depth of the workings increased by 45 m and the transport distance from 10.5 to 15 km. The total length of the railway lines is about 900 km, including 381 km of movable lines. The annual volume of track relaying work is about 720 km. However, because of a shortage of mobile, high-productivity auxiliary equipment and imperfection in the design of the rail and crosstie grid, adequate operational reliability of the railway tracks and the performance of the planned volumes of track relaying work were not provided. Excavator work stoppages related to the unsatisfactory state of railway beds constitute 5-6 percent of the calendar time.

In connection with the introduction at the pits of powerful mining and transportation equipment in recent years, the labor-intensiveness of repair work and maintenance increased by a factor of more than 2.5. At the same time, the rate of development of the repair base and the level of provision of spare parts and repair personnel still do not satisfy completely the present needs.

The technology now used for stripping work does not correspond to the most progressive technology for extraction operations. The single-bucket EKG-8I and EKG-12.5 excavators used in stripping work do not make it possible to work



benches with a planned height of 20 m efficiently, and this leads to an increase in the number of open pit benches and transportation levels, complication of the transport lines, deterioration of the efficiency of locomotive-pulled car exchange during loading, and, in the final account, a reduction in the mining and transportation equipment's productivity. In connection with this, technical re-equipping of the stripping excavator fleet is necessary.

Efficient operation of the association's open pit mines depends largely on the reliability of the railway transport that is used. Here, also, partial renewal of the dump car fleet is needed. In addition, the track design with wooden crossties and spike attachment of the rails does not correspond to the complex conditions of the operation of movable railroad tracks in open pit mines. The system for protecting the transfer switches against snow drifts and cleaning them of snow does not satisfy the local climatic conditions. The method of pneumatic blast cleaning of the switches is effective only for dry, freshly fallen snow. The level of mechanization of rail work is still comparatively low. The percentage of workers engaged in manual labor still remains significant, although it is dropping every year. In the 1981-1984 period the number of workers engaged in manual labor was reduced by 2.7 percent and 236 people were provisionally freed from it. Competitive reviews on reducing the percentage of manual and heavy physical labor are held among the collectives of the association's enterprises every year. The introduction of SBR-160 and 2SBSH-200N drilling machines, the mechanization of the charging and stemming of blasting boreholes, and the use for rail work of MShSU-3 machines are facilitating a further reduction in its level. In accordance with the "Special Purpose Integrated Programs for the Reduction of the Use of Manual Labor" that have been developed, the workers' involvement in mechanized labor at the association's open pit mines should decrease by a factor of 1.2 in the 12th Five-Year Plan in comparison with the 11th Five-Year Plan. In connection with this, an additional 557 people will be provisionally freed. The annual economic effect of the introduction of these measures will be R 5,979,000.

The extensive use of progressive crew forms of labor organization is a guarantee of the successful solution of economic and social problems. Labor by the crew method contributes to economy of working time, the rational use of material and accelerated professional growth of people. In crews there is better discipline and lower personnel turnover. A well-organized, efficiently working crew is a genuine school for the development in workers of skills for controlling production.

Purposeful work is being done in the association to improve crew forms of organizing and stimulating labor and to study and disseminate the leading collectives' work experiences. At the present time, the crew form of labor organization encompasses 7,060 workers (68.8 percent of their total number). All workers have been organized into crews in the basic production processes (extraction, stripping and blasting work and piling).

A large amount of attention is being devoted in the association to the further development of integrated and economically accountable crews. At the present time there are 74 integrated crews; 248 crews have been converted to crew economic accountability. Work is being done to introduce a progressive form of

wage payment that takes the coefficient of labor participation into consideration. The distribution of wages by this method is now used in 142 crews.

The workers, engineering and technical personnel and employees of the Ekibastuzugol Association are directing their efforts at a further improvement in labor efficiency and work quality. On the basis of an acceleration of scientific and technical progress, an improvement in the organization of labor and production, and the development of socialist competition, they have vowed to extract 200,000 t of above-plan coal in 1985, including 130,000 t by the anniversary of the Stakhanovite movement and 160,000 t by the 68th anniversary of the Great October Revolution. During the first 5 months of this year about 33.2 million t of coal was extracted and shipped to consumers, including more than 1.1 million t above the plan. In comparison with the corresponding period last year, worker labor productivity increased by 1.7 percent and was 911.3 t/month.

The association's collective will also be faced with crucial problems during the 12th Five-Year Plan. It is foreseen that an increase in extraction volumes and further technical re-equipping of the pits will be accomplished in two directions: by modernizing existing pits and opening up the Vostochnyy Pit, with a production capacity of 30 million t of coal a year, which will be equipped with highly productive continuous-action equipment. It is also planned to realize large-scale social measures: the construction of living quarters with a total area of 350,000 m<sup>3</sup>, 5 kindergartens, 3 general education schools with 4,864 seats, a pioneer and schoolboy house with 400 seats, a country dispensary with 208 beds, dining halls and cafes with 614 seats and a stadium seating 15,000. A large medical complex will be built.

The successful solution of the problems formulated for the years of the 12th Five-Year Plan will be an important contribution by the association's toilers to the creation of the Ekibastuz fuel and energy complex.

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## BRIEFS

GUKOVUGOL MINE ABOVE PLAN--Gukovo, Rostov Oblast--The miners at the Gukovugol Association's Mine imeni 50-letiya Oktyabrya, which is the largest one in Rostov Oblast, reported the fulfillment of the five-year plan for the extraction of anthracite ahead of schedule. They have sent almost 9.3 million t of high-quality fuel to the surface, each ton of which was 53 kopecks cheaper than at the beginning of the five-year plan. In all, this made it possible to save more than 5 million R. By using auxiliary materials and electricity thriftily, the miners saved another 1.5 million R. [By M. Rabichev] [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 26 Jul 85 p 1] 11746

ZARYA MINE ABOVE PLAN--Snezhnoye, Donetsk Oblast--The miners at the Zarya Mine are working with enthusiasm this year. In preparing a worthy greeting for the 50th anniversary of the Stakhanovite movement and the 27th CPSU Congress, since the beginning of the year the right-flank competitors have dispatched more than 100,000 t of above-plan anthracite since the beginning of the year. Mechanized complexes and other materiel are used efficiently at the mine and advanced experience and a progressive system for working coal beds are being introduced. The best results on the shock watch have been achieved by the second section collective led by Yu. Elshevich. Using a mechanized KM-103 complex, it extracts 1,100-1,200 t of coal every day. [By V.Vlasenko] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 Jul 85 p 1] 11746

NEW MINING EQUIPMENT ANNOUNCED--The collective at the Shakhty Scientific Research, Planning and Design Coal Institute is solving successfully the problems involved in the scientific and technical rejuvenation of coal production. Two modifications of planing complexes of a new design, intended for work in beds about 1 m thick, have been put into series production. Completion of the work on promising planing unit complexes and the Sputnik adjustable timbering is near. They will make it possible to mechanize work on beds that are at least 0.55 m thick. The institute's scientists and designers have introduced new mechanical timbering in the Rostovugol Association. Since the beginning of the five-year plan, the economic effect from the assimilation of the institute's developments has been more than 16 million R. [By M. Rabichev] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Jul 85 p 2] 11746

EXCAVATOR CREWS CONGRATULATED--Chelyabinsk--The excavator crews of V. Voronin and RSFSR Honored Driver N. Bepalov, from the Korkinskiy open pit coal mine, were the victors in the recurrent 10-day shock watch in honor of the 27th CPSU Congress. In all, since the beginning of the year the miners at this open pit

mine, which is the deepest one in the country, have already produced 230,000 t of coal because of their pregress obligations. The coal miners intend to complete their five-year plan by 7 November. [By N. Krivomazov] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 1 Aug 85 p 1] 11746

FOUR-MILLION TONS EXTRACTED--Krasnoarmeysk, Donetsk Oblast--At the Mine imeni A. Stakhanov, 4 million t of coal have now been extracted since the day it began operating. This amount of fuel was produced in only 10.5 years. The introduction of the newest equipment and progressive technology for working the beds insure high extraction rates. The miners are mastering their planned capacity ahead of schedule. Since the beginning of the five-year plan, 100,000 t of above-plan coal has been sent to consumers. [Text] [Moscow SELSKAYA ZHIZN in Russian 26 Jul 85 p 1] 11746

MINE IMENI KIROV OVERACHIEVES--Novoshakhtinsk--The collective at the Rostovugol Association's Mine imeni Kirov has had a great labor success: the miners reported the early fulfillment of the plan for the 11th Five-Year Plan. During this period, almost 2.4 million t of anthracite have been extracted. The success was achieved thanks to a steady increase in labor productivity, which has exceeded the planned level by 5.6 percent since the beginning of the five-year plan. Coal production cost was reduced by an additional 3.4 percent. The Mine imeni Kirov is not a young one, and the geological and mining conditions are complex. The shafts went deeper, the coal seams got thinner, and the mine pressure and temperature increased. The miners opposed the mean tricks of the underground elements with their skill at flow-line extraction of anthracite and professional mastery of their equipment. The collectives of the operating sections led by V. Guzikov, G. Martynyuk and V. Shepel became genuine schools for teaching how to work with high efficiency. Rich experience in the high-speed cutting of underground workings was accumulated by the collective headed by V. Donchenko. Today there are about 2,000 linear meters of workings in these footmen's above-plan account. Competing for a worthy greeting to the 27th CPSU Congress, the Kirovites vowed to send another 200,000 t of coal to the surface before the end of the five-year plan. The leaders of the pregress watch are not completing a single shift without above-plan extraction. They are the crews of working face workers led by N. Sementsov and V. Knyazev. The cutting crews of G. Polyakov, N. Yevdokimov and N. Podluzhnyy are driving underground workings at an accelerated pace. On the leaders' labor calendar it is already September now. [By M. Rabichev] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 Jul 85 p 1] 11746

ELECTRICITY OVERUSE FINES PROTESTED--Kemerovo--In June the collective at our Mine imeni Lenin produced 20,000 t of coal more than the plan specified. But for overconsumption of electricity it paid a fine--37,000 R. The entire Yuzhkuzbassugol Association extracted 292,000 t of above-plan coal and...again paid a fine for the same reason--775,000 R. The whole fact of the matter is that they supply us with energy strictly according to the limit...for the plan alone. How should it be? Supply the country with much-needed coal and have a reputation as squanderers of electricity or stop production so as to become a pet of the power supply system? [By N. Oleynik, crew chief] [Text] [Moscow TRUD in Russian 9 Aug 85 p 2] 11746

WORK ACCELERATES AT KATEK--Since the beginning of the year, work on the construction of the Berezovskiy-1 Open Pit Mine at KATEK has speeded up by a factor of 1.5. The builders have given the assemblers a special area where the assembly of unique equipment for the extraction of fuel is now taking place. [Moscow EKONOMICHESKAYA GAZETA in Russian No 35, Aug 85 p 3] 11746

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## NON-NUCLEAR POWER

### LENINGRAD GES DESIGN DIRECTOR DISCUSSES SAYANO-SHUSHENSKAYA GES

Leningrad LENINGRADSKAYA PRAVDA in Russian 30 Aug 85 p 1

[LentASS article: "'Contract of the 28': Finish of a Great Effort"]

[Text] Approaching completion is the largest hydroelectric power plant in the country -- Sayano-Shushenskaya. The Leningrad enterprises, as reported in LENINGRADSKAYA PRAVDA, have completed installation of the last unit. Today the collective of the Elektrosila Association sent to Yenisei the final components of the tenth 640,000 kilowatt generator. The turbine, hydromechanical and other equipment of the final unit are already being installed in the plant. Concrete guarantees have been received that the GES will produce at its design capacity during the current year.

Ten years ago the collectives of Leningrad enterprises and organizations working on the construction of the power station, concluded the well-known 'Contract of the 28', entered into creative collaboration and produced a unique temporary scientific-industrial working group on common principles. It set as its goal the achievement of the highest technological level for large-scale construction. This initiative was approved by the Central Committee of the CPSU. During the preparations for the 27th Party Congress the participants in the association reported that the two final units of the GES had been produced and were being delivered to Siberia and mounted in place, with savings due to improvement in design. In their level of quality the Sayan [o - Shushen Skaya] units surpass world standards.

"It can only be regretted that the group was formed many years after the beginning of the project on the Yenisey. The introduction of the latest advances in science and technology of the Leningrad group together with the Krasnoyarsk builders to a large extent have succeeded in eliminating the backlogs allowed in the first stage. But on the whole the construction of Sayano-Shushenskaya GES has gone more slowly than Bratsk, as noted at the meeting of the CPSU Central Committee on the question of accelerating scientific and technological progress," says Academician I. A. Glebov, chairman of the presidium of the Leningrad science center of the USSR Academy of Sciences. "The experience of the collaboration convinces us of its necessity in the construction of other large projects. It has been

widely used in developing and carrying out the regional program 'Intensification-90' and has already aided in the successful completion of its energy segment. In imitation of the Leningrad collaboration it was proposed to establish special temporary interdepartmental scientific and industrial collectives for solving a number of important national economy problems. The "Sayan collaboration" of enterprises and organizations of various ministries and departments became a model for new methods of management of scientific and technological progress", emphasized the scientist.

"Having set the goal to achieve a technically ideal power complex in a compressed timeframe, we encountered many acute problems," recalls the chairman of the coordination committee of the working group, the director of the Lengidroproekt Institute, Yu. A. Grigoryeu. "It required the provision of a type of a high-speed conveyer [system] for designing, developing, and introducing dozens of models of the newest equipment. But the GES outfitters belonged to different ministries and departments and, acting according to the established plans for the development of their own sections, sometimes could not take into account the concrete needs of the hydropower people. The coordinating committee, which included the directors, secretaries of the party committees, and leading scientists and specialists, undertook to direct the participants toward a general solution of all construction problems."

It was determined that to resolve the set tasks, the committee coordinated the activities of the Leningrad enterprises and organizations in 3,000 instances--after all, a delay by one of the component manufacturers threatened to disrupt the efforts of the others. The committee became the headquarters of socialist competition, the results of which were summed up on the basis of a unique document, a general interlocking schedule, showing all phases of task completion, from scientific research to the installation of equipment at the building site. Only the collective, acting in the interests of its partners with regard to the final result, could count on victory in the workers' competition.

The Elektrosila Collective manufactured and shipped by unit the last generators of the GES, in accordance with the accelerated assembly methods adopted by the Spetsgidroenergmontazh Trust. To do this the electrical machine manufacturers had to significantly condense their production schedule.

On the basis of available and forecasted advances in science and technology, the committee developed balanced counter proposals for participants in the collaboration, which afterwards found the support of the Council of Ministers of the USSR, and were established as government targets. It used to be that an invention (more than 150 of them were introduced during the equipment development process) required sudden adjustments in the plans of many institutes and enterprises. Such proposals of the coordinating committees did not have legal authority for the collectives, but the participants considered them obligatory and introduced adjustments into their own production schedules.

Just this happened during construction of customized small-scale switching substation for the GES. Fundamentally new equipment, developed after the

design was approved by a number of Leningrad scientific organizations, and produced by Elektroapparat, Elektrokeramika, and others, allowed the substation to occupy one-third less space, keeping to a minimum the rock work on the site.

With the introduction of more and more new developments, equal to the best of world-wide technology and frequently even excelling it, the impact on the national economy grew due to the improvements in the design as a whole. Not everything planned by the participants of the working group was achieved, but the main elements were. The estimated cost of the project was reduced by several tens of millions of rubles. About 100,000 tons of cement and 150,000 tons of metal were saved; the weight of machinery was reduced by 6,000 tons.

The original scheme of the Leningrad group called for the start-up of the first units of the GES as the DAM was being built, and as the reservoir was being gradually filled made it possible for the station to produce more than 150 billion kilowatts hours of cheap electricity during construction period.

The equipment developed for Sayano-Shushenskaya GES is now being used at other power projects, promoting technological progress in many areas of the national economy.

Little time remains until the start-up to the tenth unit of the station. The participants in the creative scientific-technical working group are striving with honor to complete the start-up of this important national economy project, and to make a substantive gift impending toward the forthcoming 27th Party Congress.

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## NON-NUCLEAR POWER

### SURGUTSKAYA GRES-2 PROGRESS DISCUSSED

Moscow EKONOMICHESKAYA GAZETA in Russian No 38, Sept 85 p 7

[Article by M. Makhlin: "The First Stage of Developing Natural Resources  
"under the rubric;" Western Siberia: Problems of General Development"]

[Excerpt] The Energy Center of the Complex.

Among the important projects starting up in 1985 is the second block of the Surgutskaya GRES-2, the construction of which was monitored by EKONOMICHESKAYA GAZETA. It is hard to believe that the first tower was erected only in 1983. Now one block is already producing more than two billion kilowatt hours. The pre-startup operations are complete on the second unit. It's a matter of days. In late September-early October an 800,000 kilowatt unit will be on line. "In all the station will have six 800,000 KW units," says the director of the Zapsibenergostroy Trust V. S. Vikulov. "The associated gas from local oil fields serves as fuel. The significance of the project is great. The uninterrupted work of industry greatly depends on the reliability of power supply. Our collective decided to speed up the start of operation of the blocks. Instead of two years as per the norms, we plan to turn them over in three quarters [of a year] each. The schedule was proven out on the second block. Taking part in the "work relay" [race] were many contractors for construction and equipment. Now the fate of the third block is worrying us. Kommunarsk metallurgists are delaying the delivery of rolled goods to Zuevskiy power equipment plant from which the project was to receive the ridge girders. These assemblies were scheduled to be installed in July or August. Now the cold season is approaching and still no girders. The Berezovskiy factory of structural assemblies and the Novosibirskiy factory of metal construction of the USSR Ministry of Energy, as well as the Leningrad's Elektrosila and Taganrog's Krasnyy Kotelshchik should more actively fulfill orders for the block.

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## NON-NUCLEAR POWER

### BRIEFS

**SURGUTSKAYA GRES INCREASES CAPACITY**--Surgutskaya GRES, called the energy heart of the petroleum industry and cities of the Middle Ob [River] Region, has been operating more than 10 years. Expanding construction has required a significant increase in its capacity. Therefore GRES-2 is being erected at full speed. Its first 800,000 kilowatt unit went on stream in the spring of this year. [Excerpt] (Moscow IZVESTIYA in Russian 12 Sep 85 p 1] 12805

**AZERBAIJAN GTES ON CASPIAN**--Electricity output will increase threefold with the start-up of a gas turbine power station on Neftyaneye Kamni, an oil field platform which stretches above the waves of the Caspian for 400 kilometers. The facility to be started this year will become the first GTES in the country on the sea. [Text] [Baku VYSHKA in Russian 7 Sept 85 p 1] 12805

**PROGRESS ON YUZHNYAYA TETs**--Concrete construction workers from A.A. Babkin's brigade, Energovysotspetsstroy Mobile Specialized Administration, completed construction of an 82-meter cooling tower during construction of the second phase of the Yuzhaya TETs. Now the principal attention of the construction administration collective of the Yuzhaya TETs has turned to laying the foundation of the main building of the second phase of the heat and electric power station. [By L. Efimov [Excerpts] [Leningrad LENINGRADSKAYA PRAVDA in Russian 24 Aug 85 p 1] 12805

**GEORGIAN-AZERI LEP--TBILISI**--One of the "highest" electric transmission lines in Georgia, Torgvas- Abano-Omal, has been connected to a single power system. With its coming on line the Kavkazelektrosetstroy Trust has fulfilled the targets of the five year plan ahead of schedule. The completion of electrification of all populated areas and industries of the republic allows an increase in the productivity of labor and the development of new areas, under the prevailing conditions of mountain agriculture. The trust began construction of the 500 kilovolt line running from Georgia to Azerbaijan four months before the target date. [Text] [Moscow SELSKAYA ZHIZN in Russian 1 Sept 85 p 1] 12805

**NEW TRANSMISSION LINE**--Another 220 KV transmission line was placed in service, connecting Zeyskaya GES with remote settlements on the Baykal-Amur Main Line. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 38, Sept 85 p 3] 12805

LOGJAMS COMPLICATE GES OPERATION--Before us is a recent document approved at a high level conference of the management of the under-construction Sayano-Shusshenskaya GES. It says: "Trees, brush, and stumps are becoming a serious problem in the operation of the GES; these complications are expressed by a systematic reduction of electricity output. The use of high-speed boats is ruled out in navigation on the reservoir, significantly limiting the operation of normal freight and passenger traffic. The ecology of the reservoir is disturbed and the recreation potential reduced. The drinking water of the developing projects of the national economy is degraded. Not for nothing was the alarm sounded by the managers of the still incomplete power station. No sooner had the fanfare ended over the start-up of the first units when they began to have sudden failures: sometimes another would reduce electricity output by 5-7 percent. These are big losses. It didn't require a lengthy investigation to locate the cause: the protective screens on the head race were clogged with wood. More and more often divers had to go down under water, because there is no other way to clean the screens. [By V. Prokushev and V. Komorin [Excerpt] [Moscow PRAVDA in Russian 11 Sept 85 p 3] 12805

POWER PRODUCTION ABOVE-PLAN--The Volzhskaya GES imeni Lenin Collective has fulfilled its socialist commitments of the five-year plan ahead of schedule. A half a billion kilowatts-hours of electric power above the plan has been produced here. Having joined in the competition in honor of the 27th CPSU Congress, energy workers will have given an extra three billion kilowatt-hours of electric power by the end of the year. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No. 38, Sept 85 p 3] 12805

GAES PRODUCTION IN KHARKOV--Kharkov--The Elektrot'yazhmash plant has begun production of powerful machines for water storage power stations. It has completed production of the first in series 220,000 kilowatt generator-motor for the Kayshyadorskaya GAES, now under construction at Neman in Lithuania. [Text] [Moscow SELSKAYA ZHIZN in Russian 1 Sept 85 p 1] 12805

VOLGA GES PRODUCTION--A report from Kuybyshev says that the Volga "Lenin" GES has started production of the 10 billionth kWh since the start of the year. The 5-year plan has been fulfilled ahead of the scheduled which was largely a result of the technical re-equipment of the station. [Moscow Television Service in Russian 0204 GMT 26 Sep 85] /6662

CSO: 1822/91

## PIPELINE CONSTRUCTION

### BRIEFS

**KHOLMOGORY-KLIN PIPELINE**--The 2380km-long section of the Kholmogory-Klin oil pipeline on the territory of the Perm Oblast and Udmurt ASSR has been put into use. Filling this section with northern oil was completed today. [Summary] [Moscow Domestic Service in Russian 1000 GMT 19 Sep 85 LD] /6662

CSO: 1822/93

## GENERAL

### GOSPLAN OFFICIAL DISCUSSES POWER SECTOR PROGRESS, PLANS

Moscow PLANOVYE KHOZYAYSTVO in Russian No 9, Sep 85 pp 22-30

[Article by V. Savin, deputy section chief of USSR Gosplan: "Scientific and Technical Progress in Electric-Power Engineering"]

[Text] At all stages of development of the country's economy, the fuel and power branch has been developed at a faster pace than industrial production. As a result the USSR has created a high-capacity highly effective fuel and power complex in which almost a third of all industrial-production resources and more than a third of capital investment is concentrated.

The USSR Energy Program, which was developed for the long term, has defined the strategy for further developing the fuel and power complex. Its basic propositions in the area of electric-power engineering consist of the following:

- implementation of an active energy-saving policy based upon accelerated scientific and technical progress and a saving of fossil fuel (primarily petroleum) through the preferential use of nuclear fuel and renewable resources;
- speeded-up construction of nuclear stations for producing electricity and heat;
- accelerated construction of high-capacity thermal electric-power stations that use cheap coal mined by the stripping method (the Kansk-Achinsk and Ekibastuz basins);
- the economically justified integrated development of the hydropower resources of Siberia, the Far East and Central Asia; and
- the creation of a technical and materials base for the wide use of breeder reactors, the energy of thermonuclear fusion, and nontraditional renewable sources of energy.

The USSR is the world's only large industrially developed nation that provides itself completely with fuel and energy through use of its own resources.

In the long term, almost all growth in fossil-fuel recovery will come from the country's eastern regions, at a time when the demand for energy resources

in the European area continues to increase. Under these circumstances, power engineering, aside from its effect on the country's economy by electrifying it, takes on a new role--a tool for transforming the structure of the country's fuel and power balance and incorporating in it nuclear energy, hydropower and cheap low-calorie steam coals, which will allow the share of mazut in the total consumption of electric-power engineering resources to be cut to less than half by 1990.

Definite successes have been achieved in developing domestic electric-power engineering. During the first four years of the current five-year plan, the generation of electricity increased by almost 16 percent, reaching 1,493 billion kWh in 1984. The rated power of the country's electric-power stations has exceeded 300 million kW. More than 23 percent of all the electricity is being generated at nuclear-power and hydropower stations, enabling about 100 million tons of fossil fuel per year to be replaced, according to a provisional calculation. The share of high-capacity electric-power stations and power units is growing. Formation of the country's Unified Power System continues.

The main directions for scientific and technical progress in electric power are selected on the basis of the goals for increasing efficiency in the production and use of fuel and power resources, the transmission of electric power and heat, reduction in losses of power, a lessening of the use of officially acceptable grades of fuel, and a rise in labor productivity--all without exceeding the permissible discharges into the environment.

In nuclear-power engineering, technical progress is marked by the wide introduction of thermal-neutron based VVER-1000's [1,000 MW water-moderated water-cooled power reactors] and RBMK-1,000's [1,000-MW high-capacity channel reactors] and RBMK-1500's, start of the erection of large AES breeder reactors, and the use of nuclear energy for producing heat at nuclear TETs's and nuclear heat-supplying stations.<sup>1</sup>

At present about 77 percent of the electricity is being generated at thermal power stations--the largest consumers of fuel. About 40 percent of all the economy's consumption of boiler-and-furnace fuel is used at TES's to generate electricity and thermal energy. If fuel consumption at boilerhouses to produce heat is added, then its value rises to almost 60 percent.

It is clear what an immense effect heat engineering exercises on optimization of the fuel and power balance. In its turn, its structure governs the choice of direction of scientific and technical progress.

One of the main tasks of thermal power in saving fuel, making rational use of all types of resources, and saving energy is that of increasing the equipment's economic performance by introducing new technical solutions and raising the operating level. A set of measures for improving the generation of electricity at TETs's under growth in the introduction of high-capacity power units at supercritical steam parameters, expansion of district heating, and modernization and dismantling of obsolete equipment has enabled

<sup>1</sup>For more detail about scientific and technical progress in nuclear-power engineering, see the article, "Nuclear-Power Engineering," by G. Shasharin in PLANOVOYE KHOZYAYSTVO [The Planning Activity], No 10, 1984.

the consumption of standard equivalent fuel per 1 kWh of electricity at the power-station switchboard to be reduced to 326.8 grams in 1984 versus 366 grams in 1975.

Power units of 150,000 to 1.2 million kW are the basis of thermal power engineering.

Wide construction of electric-power stations of high unit power, including the TES's of the Ekibastuz and Kansk-Achinsk fuel and power complexes, is called for. Power stations of 4 million kW each with 500,000-kW power units are being built at the first, stations of 6.4 million kW each with 800,000-kW power units at the second. Special power units that take account of the peculiarities of local fuel are being built for the coals of the Kansk-Achinsk and Ekibastuz fields. Their technical and economic indicators are far better than those of 300 MW power units. Specific capital investment and materials intensiveness have been reduced by 10-20 percent, operating manning per unit of rated capacity is 30-50 percent less, and the economy of the units has been raised by 2-3 percent.

A most important task of the power engineers and the machinebuilders is that of introducing power equipment that is less metals intensive and of smaller dimensions.

The creation of steam generators of 420 tons/hr productivity with fluidized-bed firebox was started during the 11th Five-Year Plan. A peculiarity of this type of firebox is the possibility of burning in it fuel with a wide range of characteristics, and also a reduction of harmful discharges into the atmosphere. Power equipment of 500,000 kW capacity fired by Baltic shale is being created; it is to operate in the variable portion of the electrical load curve. This is especially important for the country's North-western region. New developments include industrial testing of a model of a power-engineering steam generator of 800 tons/hr productivity with a ring firebox, a head gas-turbine installation (GTU-150) of 150,000 kW power and a gas temperature of 1,100 degrees C ahead of the turbine, and an industrial test steam-and-gas turbine district-heating installation PGU-250 with intracycle gasification of solid fuel.

Steam-and-gas installations (PGU's) are being used to increase fuel utilization efficiency. A combining of gas-turbine and steam-turbine installations in one heat cycle will permit a high-temperature feed (in the gas-turbine plant) and a low-temperature withdrawal (in the condenser of the steam turbine) of heat to be united, the KPD [efficiency] of the cycle to be raised thereby, and, consequently, economy in producing energy to be provided for. Experience in PGU operation in our country and abroad has indicated that their main advantages are high economy, capital costs lower than those of classical thermal stations, a high degree of factory fabrication of the equipment, the possibility of automation and substantial reduction of servicing personnel, rapidity of starting, and high economy under partial loads. However, they can operate only on a gas or liquid fuel, and this restricts their wide use.

Our country is operating PGU's with a high-head steam generator (the PGU-200) and with discharge of gases into an ordinary steam generator (the PGU-250); and a PGU with intracycle coal gasification is being erected.

The introduction of magnetohydrodynamic installations (MGD's) will permit the energy of the fuel being burned to be transformed directly into electricity with high thermal efficiency, approaching 50 percent or higher. Work to create them is being performed relative to various types of fuel, including coal.

MGD generators can be used in combination with steam turbines, GTU's and PGU's. An MGD-500 installation of 500,000-kW power, based upon gas, is being erected at the Ryazanskaya GRES.

An important place in realizing the USSR Energy Program is assigned to district heating, primarily to the combined production of electricity and thermal energy.

The modern status of heat supply for the national economy as a whole is marked by a high technical and economic level. Heat consumption is about 3,500 million gigacalories, more than 2,500 million of it from centralized sources. TETs's give more than 50 percent of the heat from centralized sources.

District heating as a most progressive type of centralized heat supply has, in 60 years, reached in the USSR a scale unknown in any other country. Both right now and in the long term, this is the most effective area of centralized heat supply for the country.

The rated electrical capacity of TETs's at the start of 1985 was more than 85 million kW.

Along with the country's large enterprises, about 270,000 small boilerhouses with productivities of less than 20 gigacycles/hr are operating. Such boilerhouses and boilerrooms produce about a third of all thermal energy.

With a view to putting order into the operation of heat-engineering activities, steps have been taken to increase the efficiency of the heat-engineering activity of cities and other communities.

Great economic benefit can be obtained by Union-republic councils of ministers by developing and realizing the tasks of eliminating and modernizing existing small boilerhouses and regularizing the heat-supplying system.

The further development of centralized heat-supply, including district heating, is specified for both fossil and nuclear fuels. These guides consider the specific peculiarities of the European and the eastern regions of the country. In the European area, it is economically effective to use nuclear power for producing not only electricity but also heat energy.

The consistent growth in the concentration of heating loads both in industry and in the housing and municipal services of cities creates the prerequisites for further rationalization of the structure of heat-supply sources.

In the European portion of the USSR, west of the Urals, nuclear heat and electric-power centrals (ATETs's) are being developed. Siting of the ATETs's is specified for the larger cities where there are heat-load concentrations of 1,500 gigacalories/hr or higher. For cities with medium-size concentrations of heat loads (1,000-1,500 gigacalories/hr), it is desirable to build nuclear heat-supply stations (AST's).



In accordance with the USSR Energy Program, ATETs's based on VVER-1000 reactors and 500-MW district-heating turbines are being built in Odessa and Minsk; construction of the first large AST's, which will supply heat for Voronezh and Gorkiy, started during the 11th Five-Year Plan. A substantial portion of the heat load is to come from condensation-type nuclear electric-power stations through nonadjustable withdrawal of steam.

In the long term, a new role will be assigned to fossil-fuel fired TETs's. In order to solve the problem of the variable portion of the daily electric-power load curve, it is desirable in the European parts of the country to involve TETs's in flexible-mode operation. Its equipment should provide for operation with regular unloadings, right down to the full cessation of the delivery of electric power into the system. In this case, heat is released from the ROU [reducing and cooling unit], peak-power sources or heat accumulators. Research in this area is already being performed at some TETs's.

New TETs's must be built in the flexible version in the European area, but, without waiting for this, even today existing installations must be converted to flexible-mode operation.

Traditional development of centralized heat supply, primarily district heating based on fossil fuels, is called for in the eastern regions.

A considerable reserve for increasing the release of energy by the combined method with minimal losses is the use of GRES's for district heating. USSR Minenergo [Ministry of Power and Electrification] has already prepared and implemented recommendations for the use of 150-, 200- and 300-MW turbines. after they are rebuilt, with conversion to a district-heating mode.

One of the main routes for saving fuel is that of increasing the load of existing TETs's which are underloaded at present.

Main areas for saving fuel and power resources in a most important component of district heating--the system for transporting and distributing the heat carrier--are a rise in the designed temperature of the water in the delivery lines to 170-190 degrees C, wide introduction of single-pipe systems for transporting the heat, a rise in the reliability of heat-supply systems, and durability of the heating lines.

Especially important is the question of creating and distributing means for operational monitoring and automating production processes and control of the country's heating activity, both for heat-generating installations of various types (TETs's, ATETs's, AST's, boilerhouses, boilerrooms, and so on) and for the heating grids and for modern complicated heat-supply systems as a whole. In accordance with a decision of USSR Gosstroy and the Scientific Council of the USSR Academy of Sciences on Integrated Problems of Energy, 17 cities are conducting an experiment on the integrated automation of heat supply and heat consumption. Its purpose is to find a more efficient way to solve the most important problems and to recommend it for wide introduction.

Centralized heat supply--above all, district heating--is one of the most important sources of fuel savings for the national economy.

In order to increase the efficiency of centralized heat supply, it is necessary to: optimize heat-supply systems on the basis of an economically desirable combining of ATEs's, AST's, ASPT's, flexible TETs's, large boilerhouses and other heat-generating sources, including the use of nontraditional types of energy, secondary heat resources, heat pumps, and so on; execute technical and organizational measures, namely: the dismantling, rebuilding and modernization of worn and obsolete equipment of electric-power stations and boilerhouses, and improvement of the operating level and radical improvement of the technology and the quality of repair work; and organize the active reporting and monitoring of energy-resources consumption, including automation of centralized heat-supply systems.

An important problem in the modern era and in the long term is the dismantling, modernization and rebuilding of obsolete equipment. In the first stage of Energy-Program implementation, equipment with total capacities of 55-60 million kW should be dismantled and modernized, at the second stage 70-80 million kW. Rebuilding is justified if the expenditures are so small and a benefit is obtained in the form of an extension of service life, and if improvement of the operating indicators are so favorable that, judging by the adjusted expenditures, rebuilding is more suitable than dismantling and introducing new equipment. Work is now being done to evaluate the economic effectiveness of replacing various types of operating equipment. Taking this into account, a conclusion about the scale of rebuilding over the long term can be drawn, based upon the experience of a number of electric-power stations.

The Energy Program pays special attention to the use of hydropower resources.

Hydropower engineering has an appreciable role in the country's electric-power system in regard to both the amount of rated capacity of hydropower stations and the amount of electricity they generate.

The rated capacity of existing GES's is about 60 million kW, and in 1984 power generation exceeded 200 billion kWh.

A substantial, still unused national hydropower resources potential, if it is oriented to saving fuel and power resources in every possible way, is an important prerequisite to the further development of hydropower engineering.

Even today the annual generation of electricity at GES's is equivalent to a saving of more than 60 million tons of standard fuel equivalent. But use of the economic potential of the USSR's hydropower resources does not exceed 20 percent.

The factors that dictate wide development of the hydropower potential should be singled out:

--the constant renewability of the resources, and, consequently, the possibility of replacing fossil fuel;

--the low prime operating cost of electricity at GES's, because of the lesser material and labor costs for operation and lesser in-house consumption of electricity in comparison with other power stations; and

--the high flexibility of hydropower equipment, which permits it to operate in the variable portion of the load curve and to perform the functions of an operational and emergency reserve.

In determining the scale and pace of developing hydropower engineering resources, it is necessary to break down the integrated use of water resources, which calls for (beside the generation of electricity) irrigation, water supply for industrial and municipal-services customers, the creation of better conditions for water transport on navigable rivers, and the protection of adjacent lands from flooding.

The role of hydropower in national economic development in newly developing regions is great. Large hydroelectric power stations have become, as a rule, the base for the industrial development of whole regions. Where there are large GES's, new settlements, cities, construction-industry bases and new and reliable transport ties are created. So it was during the construction of GES's on the Volga and Dnieper rivers and in Central Asia. The development of hydropower resources in Siberia and the Far East has had especially great significance. The construction of the Angara-Yenisey cascade of GES's, for example, laid the start for the formation of most huge regional production complexes and for the development of natural resources in the country's east.

Both the factors that promote and those that restrain this process affect the development of hydropower construction. They include the long time taken to erect hydroelectric-power stations and the specific capital investment for construction, which is higher than for other sources of electrical energy. Such objective factors as the development of new remote regions, the considerable growth of compensational expenditures because of flooding of the land, redistribution of the population, logging, and so on, also affect their value.

The high cost of erecting GES's is alleviated to a substantial degree by the introduction of progressive engineering solutions.

Our country's largest hydroelectric stations have been built with capacities of 2 million kW and more on the Volga, 4.5 million kW on the Angara (the Bratskaya GES), and 6 million kW on the Yenisey (the Krasnoyarskaya GES). The unit capacities of hydropower units is rising rapidly. Units of 72,000 kW power were introduced at Dneproges [Dnieper Hydroelectric Power Station imeni V. I. Lenin] in 1950, units of 500,000 at the Krasnoyarskaya GES in 1971. The Sayano-Shushenskaya GES is being completed with units of 640,000 kW each; and units of still higher power are in the development stage.

In speaking about hydropower development, the special importance of the construction of pumped-storage electric-power stations (GAES's) in the European part of the USSR must be emphasized. Capable of a broad range of regulation and high response speed, GAES's can provide an optimal operating mode for the power system, since they are highly flexible sources of peak capacity and are energy-intensive regulator-users. Under construction now are the Zagorskaya GAES in Moscow Oblast and the Kayshadorskaya GAES in the Lithuanian SSR, and it is planned to build a number of other GAES's.

Increase in the generation of electricity necessitates the accelerated development of intersystem electrical ties, and the continued formation of the

USSR Unified Power System (YeES SSSR). The YeES SSSR includes nine amalgamated power systems (OES's). Moreover two OES's (Central Asia and the Far East) will be linked up in the near future. The task of building the YeES SSSR is being solved by a system of high-voltage electric grids which will provide for the steady parallel operation of power systems and the transporting of ever-growing streams of power.

The main directions of scientific and technical progress in the transmission and distribution of electricity are:

the construction of electrical transmission lines of increased throughput by raising their nominal voltages to 1,150 kV AC and 1,500 kV DC;

improvement of the geometry of siting conductors;

the creation of new and the improvement of existing types of substation equipment with improved technical and economic indicators, particularly installations with gas-dielectric insulation and sources of reactive power which permit losses to be reduced and the quality of the electricity to be improved; and

the creation and introduction of new installations with a view to improving the quality of control of electric-grid regions (control-type communications).

Our country has built high-capacity basic grids for the YeES SSSR with electric-power lines of 500 and 750 kV AC (1,150 kV in the not so distant future).

A number of scientific and technical problems remain to be solved before a DC power grid can be established. A test section of a 1,500-kV DC power line is now being erected that will enable a check on the operating current and the voltage of the equipment and the control systems, an accumulation of practical experience in the operation of transformer technology, and the development of measures for increasing the operating reliability of DC transmission.

Special attention should be paid to reducing power-grid losses. The increased density of power-line current, which leads to growth in the grid's load and an inadequate degree of compensation for reactive power, exerts a considerable influence on the level of losses in the power grids, aside from growing over-currents of power and energy. Thus, at the start of 1985 the degree to which power grids were equipped with compensating installations was 0.29 KVar [kilovar] per 1 kW of maximum load.

According to Energosetproyekt [All-Union State Survey, Design and Scientific-Research Institute for Power Systems and Electric-Power Grids] calculations, in order to reduce electric-power losses in grids by one point, the degree of compensation for reactive power must be increased about 1.5-fold, these compensating installations to be introduced by both USSR Minenergo grids and grids owned by the users of the electricity.

In order to resolve this task, Minelektrotekhprom [Ministry of Electric-Equipment Industry] should deliver the required number of compensating installations.

Unevenness in electrical consumption requires that USSR Minenergo power systems put into operation special flexible equipment, mainly GAES's, increase

the regulating potential of thermal power stations, develop intersystem power lines, and make wider use of regulator-users in industry, agriculture and enterprises of the services spheres, including domestic services. Regulator-users should have a system for centralized control.

Much attention has been paid recently to the use of nontraditional renewable energy sources: solar, geothermal and wind. The USSR Energy Program calls for the creation of a technical and material base for the wide use of these energy sources. The annual production of energy resources through nontraditional sources of energy will be 20-40 million tons of standard fuel equivalent by the end of the century. The main portion of it will be obtained by the use of solar and geothermal energy, as well as biomass.

Despite the fact that operating schemes for using renewable energy sources that have been developed at the industrial-test level are still distinguished by high intensiveness of materials and capital investment and are not perfected enough, developments in introducing promising areas of scientific and technical progress that are available in science's assets permit the hope that sufficiently economical heat-energy and electric-power installations based on these energy sources will be obtained by the end of the next five-year plan. Systems for transforming geothermal energy that have been built on an industrial scale are enabling the production in the North Caucasus and Transcaucasia regions of heat energy that is competitive with that generated by boilerhouses that operate on imported coal and mazut. In the southern regions of Transcaucasia, Turkmenia and Uzbekistan, solar heat supply is economically effective in comparison with small boilerhouses that operate on coal and mazut.

In some parts of the country, electricity generated by renewable energy sources is competing successfully with thermal electric-power stations that use traditional fuel. Thus, expenditures on electricity generated by geothermal installations in Far East regions are half as much as those at mazut-fired thermal electric-power stations.

In such regions as the Arctic Ocean, the Transbaykal, the country's mountainous regions, and so on, where wind speeds exceed 5 m/sec, electricity supplied to decentralized consumers by small-capacity wind-power units is more economical than that coming from diesel-fueled electric-power stations.

USSR Minenergo is paying great attention to questions of protecting the environment. Basically, electric filters are used to scrub flue gases of ash at thermal electric-power stations that have units of 300,000 kW or more. Smaller steam generators are equipped with wet ash traps.

Construction of an installation for scrubbing flue gases by the ammonia-cycle method has started. As for scrubbing nitrous oxide gases, support for suppressing them during the burning process is given by two-stage combustion of the fuel, recirculation of flue gases, minimal air losses, the use of special burners, and so on.

The water basin is protected by an overall reduction in fresh-water consumption and by the increased use of recycling water-supply systems, and by reduction in the discharge of effluent.

During the current five-year plan, a set of operations for creating TETs's that do not discharge effluent into water bodies is being realized. However, improvement of water-preparation technology is proceeding slowly, the mastery of instant-boiling evaporators is being hampered, electrolysis for desalinating water and waste is being introduced slowly, reverse osmosis is not being used widely, and so on. One of the main factors that hamper solution of the problem of preventing the discharge of effluent is the absence until now of specialized production in the matter of the development, manufacture and delivery of equipment for water preparation and the cleaning of effluent. It would be desirable to have such production in Mineenergomash [Ministry of Power and Transport Machinebuilding].

The role of design and scientific-research institutes engaged in the design of energy-engineering enterprises should be noted. A reduction in the budget estimated costs and in material resources used in construction, a shortening of the time taken to erect facilities, and a reduction in operating expenditures--these are the main areas for scientific and technical progress in this field.

Reserves for building energy-engineering capacity should be found by purposeful work on unifying solutions and automating the basic industrial process of controlling power-unit equipment, improving flow sheets and the configurations of auxiliary processes, especially for fuel delivery and water preparation at thermal electric-power stations, interlocking buildings and structures, and using consolidated construction-technology modules whose composition will include the constructional structure, auxiliary operating equipment, pipelines, fixtures and insulation.

Much must be done to mechanize manual labor in the construction and operation of power-engineering enterprises.

In building electric-power grids, scientific research and experimental design is being performed on the application of insulated polymers for the manufacture of insulators, interphase spreaders, and so on.

Resolution of long-range tasks associated with optimization of the fuel and power balance, with the levels of electrification of branches of the national economy, and with the creation of fundamentally new methods for obtaining and transmitting electricity and heat are of great importance.

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